Air Quality Sustainability Program in Coconino County

Working Paper 1
Background

Prepared for

Arizona Department of Transportation

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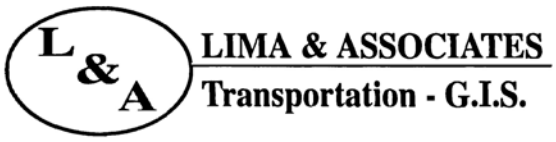

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1. INTRODUCTION

Coconino County is the largest county in Arizona and the second largest in the United States. The 18,608 square mile county is one of the more topographically diverse regions of North America, containing scrub deserts, vast prairies, and numerous mountain ranges. In addition to the Grand Canyon, tourists from all over visit Wupatki and Sunset Crater National Monuments, Walnut Canyon, and Oak Creek Canyon. Attractions in Northern Coconino County include Lake Powell National Recreation Area, Pipe Springs National Monument, Marble Canyon, and the Vermilion Cliffs.

The County has four communities incorporated under the laws of Arizona: Flagstaff, a statistical metropolitan area, Page, Williams, and Fredonia. Two other communities, Leupp and Tuba City, are designated urban centers of the Navajo Nation.

Improving both the air quality and the level of visibility in Coconino County are increasingly recognized as essential goals. This paper is intended as a background resource for the Technical Advisory Committee addressing the improvement of air quality and visibility in the County. Following this introduction are six additional chapters.

Chapter 2 summarizes the socioeconomic conditions in the County including area demographics and transportation services.

Chapter 3 discusses national and state air quality considerations, including federal and state air quality standards and visibility regulations that have been established, and state air quality planning. The sources of air pollution and nationwide air pollution trends are summarized. As a reference, the economic and societal costs of becoming a nonattainment area are presented.

Chapter 4 examines the status of air quality in Coconino County, and presents data on current emission levels. The characteristics and health impacts of major pollutants are reviewed.

Chapter 5 reviews general categories of air quality improvement strategies, and Chapter 6 reviews air quality outreach programs that have been implemented nationwide, together with those that are in place elsewhere in Arizona.

Chapter 7 discusses local plans and programs currently in place in Coconino County that include—or could include—air quality-related components, or that can serve as models for the development of air quality and visibility improvement or air quality outreach programs.

In this and subsequent draft working papers, the tables and figures pertinent to each chapter will be grouped in the back of the chapter. In the Final Report for the project, the tables and figures will appear following the text that refers to them.

2. SOCIOECONOMIC CONDITIONS IN COCONINO COUNTY

The preservation of air quality and visibility in a region is inexorably linked to that area's land use and transportation policies, as well as to the ways in which area growth and development occur. The number of vehicle miles traveled (VMT), miles of roads paved, area's commitment to alternative modes of transportation, and area home heating practices all affect the ability to preserve clean and clear air. This chapter briefly reviews area demographics and area transportation systems as a basis for understanding the challenges faced in sustaining air quality for Coconino County.

CURRENT DEMOGRAPHICS

Based on the US Census, the Year 2000 population of Coconino County was 116,320 residents. The County had a total of 52,443 housing units. Of these, 40,448 units were occupied, 12,995 units were vacant, and 9,155 units are for seasonal, recreational, or occasional use. The average household size in the County was 2.80. A total of 8,143 persons, or 7.0 percent of the total, were aged 65 years and over. Of the total County population, 65.1 percent were White, 29.7 percent were Native American, 10.9 were Hispanic or Latino, 1.4 percent were black or African American, and 1.1 percent were Asian.

The U. S. Census Bureau projects that total Coconino County Population will reach 152,002 by 2012 and 173,455 by 2022.

Table 2-1 profiles several socioeconomic characteristics that have a direct bearing on the improvement of air quality and visibility. While almost seven percent of County households lack automobiles, less than one percent of those commuting to work used transit. However, more than 16 percent of County commuters carpool. These statistics reflect the broad dispersion of persons within the county, but also suggest that a niche for additional local and regional transit services exists. Over 15 percent of homes use wood as a heating fuel, suggesting that adherence to and enforcement of local woodburning stove ordinances are critical components of any air quality improvement effort.

County land use and ownership is as varied as the topography, and much of the land is owned or controlled by public sector agencies including agencies of the federal government and the State of Arizona or by Native American tribes. County land ownership is depicted in Figure 2-1.

TRANSPORTATION SYSTEMS

Coconino County's transportation system includes a variety of modes and methods by which persons and goods travel to, within, or through the County. While the majority of trips within Coconino County take place by automobile, hundreds of persons use aircraft, Amtrak, buses, electric trains, horses, houseboats, pack mules, river rafts, steam trains, and trucks each day for recreation or passenger and freight transportation. Both alpine and cross-county

skiing are popular during winter months, as are hiking and bicycling the remainder of the year. Flagstaff is expanding its transit and urban trail systems, and the Grand Canyon National Park is planning for additional transit services.

When Europeans first began exploring and settling in the West in the 19th Century, the need for a transportation route roughly following the 35th parallel was realized. This corridor connected the New Mexico settlements of Santa Fe and Albuquerque with the West Coast, forming a continuation of the Santa Fe Trail from Missouri. Consequently, the corridor became occupied, in turn, by Beale's Wagon Road, the Atlantic and Pacific (now Burlington Northern Santa Fe) Railway, Route 66, and Interstate 40. Mormon settlers traveling between Salt Lake City and the Salt River Valley passed through the area, creating a North-South corridor. The major elements of the County's infrastructure are depicted in Figure 2-2.

Roadways

Interstate 40, the successor to historic Route 66, is a major transcontinental transportation corridor used by motorists, truckers, and intercity buses. County communities such as Flagstaff and Williams enjoy both the economic benefits and convenience of being located along I-40. The County's other interstate, I-17, travels south from Flagstaff through Munds Park before entering Yavapai County on its way to Phoenix. Major two-lane arterials in the County include US 89 from Flagstaff to Page, and US 180 connecting Flagstaff with Grand Canyon. In Northern Coconino County, Alternate US 89 connects US 89 with Fredonia and Jacobs Lake, and US 160 connects US 89 with Tuba City and the Four Corners.

State Route 64 travels between Williams and Grand Canyon, and between Grand Canyon and Cameron. State Route 67 connects Jacobs Lake with the North Rim of the Grand Canyon, and SR 264 heads east from Tuba City to the eastern county line on its way to Window Rock, traversing the Navajo Nation and the Hopi Tribe reservations. State Route 89A travels south from Flagstaff to the southern county line and a spectacular trip through Oak Creek Canyon, and SR 87 traverses the southeastern portion of the County connecting Payson (in Gila County) and Winslow (in Navajo County).

Corridor and/or access management studies have been—or are being—conducted on nearly all of these important roadways, including I-40, US 89, SR 64, and SR 264. The studies that have been completed have all recommended improvements that will need to be made to these and local and urban streets as area population and development increase. Roadway paving and the increasing efficiency and cleanliness of automobile engines will have the effect of reducing dust while the increase in vehicle miles traveled brought on by population growth will contribute to mobile sources of air pollution.

Aviation

Five major airports serving Coconino County are located at Flagstaff, Grand Canyon, Page, Tuba City, and Williams. Flagstaff, Grand Canyon, and Page all have commercial airline service. In fact, the Grand Canyon airport, located at Tusayan, is the third busiest in the state following Phoenix Sky Harbor and Tucson International Airports. The Grand Canyon airport is also the only airport in the state that is operated and maintained by the Aeronautics Department of the Arizona Department of Transportation (ADOT). Over 40 air taxi and commuter carriers serve the airport. Annual aircraft operations for fiscal year 1999-2000 at Grand Canyon National Park Airport totaled 162,575, handling 1,207,817 passengers. Scenic Airways connects the airport with Las Vegas several times daily in each direction.

Flagstaff's Pulliam Airport, located south of the city, is served by America West Express with four flights to and from Phoenix daily. Page has daily service to both Phoenix and Denver provided by Great Lakes Aviation, a regional carrier.

At the same time that Flagstaff's population continues to grow, the introduction of mid-size, fuel-efficient "regional jet" aircraft is making the addition or enhancement of service to small- and medium-sized markets more appealing to the airline industry. However, Flagstaff's altitude and winter storms will always tend to adversely affect aircraft operations, and, of course, the airline industry nationwide continues to struggle after the September 11, 2001, terrorist attacks.

Rail Service

Coconino County is served by three railroads responding to a variety of market niches. The Burlington Northern Santa Fe (BNSF) is a Class I interstate railroad providing service across the southern part of the County in the same corridor as I-40. The railroad corridor is one of the most active in the BNSF system, providing direct service between the ports in California to the Midwest, centered in Chicago. The track structure is Class *5* rated for 80-mph freight and 90 mph passenger service and is double-tracked with centralized traffic control signals. On the average, about 100-million tons of freight is moved annually, equating to approximately 80 trains a day. Of those daily trains, 70 percent operate between the hours of 12 a.m. to 12 p.m. Burlington Northern Santa Fe has a major interchange point at Williams Junction for traffic moving Southward to the Phoenix market.

The trains often consist of 100 or more cars with loads weighing 7,000 tons or more and are intermodal in nature, usually composed of containers, trailers, and auto racks. The Phoenix connection at Williams Junction moves an average 8-million tons of freight annually, using approximately 7 trains each day. The line also hosts Amtrak's *Southwest Chief*, which operates daily between Los Angeles and Chicago, stopping at Flagstaff and Williams Junction.

The Grand Canyon Railway operates excursion passenger service daily between Williams and Grand Canyon using historic steam and diesel locomotives and a wide selection of restored rail passenger equipment. The popular railway has been operating since 1989 and

carries approximately 160,000 persons per year. Grand Canyon Railway has expressed an interest in expanding its service and in operating other rail transit service into or within the National Park, further reducing automobile usage in the area.

The Black Mesa & Lake Powell Railroad (BMLP) is a dedicated facility that operates between the Peabody Coal Company's Black Mesa Mine near Kayenta on the Navajo Nation and the Navajo Generating Station power plant at Page. The BMLP uses electric locomotives and operates approximately three round trips daily between the mine and the power plant. No passenger service is operated.

Rail freight service volume is expected to continue growing. However, both environmental pressures from California and elsewhere and rising fuel costs are leading to the development of cleaner and more fuel-efficient diesel locomotives (as is the case with motor vehicles). It is unlikely that rail-related contributions to the degradation of air quality and visibility will increase significantly over time. Amtrak, for its part, has recently experienced a change in top management that, in the near term, increases the likelihood that the Southwest Chief will continue to operate. The September 11 attacks have, among other things, caused the federal government to reevaluate the current modal split of passenger transportation nationwide and to reexamine the appropriate levels of passenger rail service. Over the long-term, Amtrak service through Coconino County could remain the same, increase in frequency, or disappear altogether. The fortunes of the Grand Canyon Railway, a privately owned company, are tied more directly to trends in tourism discussed below.

Transit

Flagstaff Area Transit

Mountain Line Transit, Northern Arizona University (NAU) Mountain Campus Transit (MCT), and two special needs service operators provide transit services in Flagstaff. Each of the services is described below.

Mountain Line Transit currently maintains a fleet of six transit vehicles on a fixed route system. The total annual ridership is 130,000 passengers and growing. On an average weekday, 413 people are using the system. On Saturdays, about 200 passengers are transported on a reduced schedule. Mountain Line Transit vehicles are equipped with wheelchair lifts and many of the stop locations are accessible; the system also offers "Bike and Bus" a program that allows passengers to transport their bicycles in bike racks mounted on the front of the buses.

Mountain Line Transit is the region's public transit company, functioning as a joint operation of the City of Flagstaff and Coconino County. Service is provided on the following routes Monday through Saturday from approximately 6 a.m. through 6:30 p.m. on four routes at a 60–minute frequency:

- Route 1: Route 66
- Route 2: Cedar Ridge

- Route 3: Butler
- Route 4: South Flagstaff

The four routes serve 36 bus stops in the City of Flagstaff, five of which are planned to be discontinued in October 2002. Transit service will expand in the near future through the establishment of new bus routes and the acquisition of new buses. Additionally bus frequency will be reduced from the current 60 minutes to 30 minutes. With these improvements in place, Mountain Line Transit estimates that transit ridership on its system will quadruple.

The Mountain Campus Transit provides transit services at no charge on the NAU Campus, five days a week, between 7:30 a.m. and 11:00 p.m. The MCT operates seven shuttle buses and serves the campus community at fourteen shuttle stops. Additional services such as on-campus transportation are provided through the MCT fleet. All of the MCT routes stop at the Butler-Humphreys Transfer Center, exchanging passengers with the Mountain Line system. Mountain Campus Transit currently carries approximately 500,000 passengers annually. The system is funded by the NAU Parking Services Department with proceeds from campus parking permits and fines.

Special Needs Services are operated by the Coconino County Community Services Department Council On Aging (CCCSD) and the Hozhoni Foundation. The CCCSD, facilitated by the Coconino County Community Services Department, provides dial-a-ride "Van-Go" transportation services to the elderly, mentally and physically challenged, and low-income persons. Curb to curb transportation services is provided to these individuals to specific areas Monday through Saturday. Trip purposes include nutrition, employment, education, shopping, medical, social services, and social recreation. Transportation is provided to residents of the City of Flagstaff and the City of Williams who reside within the city limits and surrounding areas. CCCSD also provides emergency services, and home care for the elderly.

The Hozhoni Foundation is a non-profit organization catering to the needs of physically and mentally handicapped persons in the Flagstaff area. The Foundation operates a center facility and a system of group homes. Transportation is provided to and from the center for both group home residents and clients who live in their own homes or with family. The Hozhoni Foundation is a recipient of Section 5310 special needs transportation funding from the Federal Transit Administration administered by ADOT. The Foundation owns and operates a fleet of approximately 24 vehicles, which includes two wheelchair lift-equipped vans. The Foundation also contracts with Van-Go for additional transportation services.

Native American Transit Services

Navajo Transit System (NTS) operates a comprehensive network of bus routes serving Navajo Nation Communities. Service in Coconino County consists of daily service from Tuba City to and from Window Rock operating over SR 264. Six other NTS routes operate in other counties, as well as in New Mexico, serving other portions of the large reservation.

Hopi Senom Transit Service operates daily transit service between Flagstaff and Kykotsmovi, the seat of the Hopi Tribe, via Leupp. Hopi Senom also operates service between Kykotsmovi and Keams Canyon.

Grand Canyon National Park

The National Park Service operates a shuttle bus system within the National Park, and plans to implement a service connecting Grand Canyon Village with Tusayan. Initial plans to construct a light rail system between the two places were put on hold, but have resurfaced. Other options include a traditional bus operation, or a bus rapid transit route.

TOURISM

As previously mentioned, Coconino County has an unusual number of unique tourist attractions. Tourism accounts for a significant portion of area economic activity as well as passenger transportation and motor vehicle usage. Table 2-2 shows the growth in annual visitation between 1991 and 1998 at six key tourist attractions: Glen Canyon National Recreation Area, Grand Canyon National Park, Pipe Springs National Monument, Sunset Crater Volcano National Monument, Walnut Canyon National Monument, and Wupatki National Monument.

Visitation at most of these locations increased steadily until the mid 1990s, when a decline in visitation began. For example, visitation at Glen Canyon National Recreation Area was 2,442,990 in 1998, down from a peak of 3,587,754 in 1992. However, the Grand Canyon's most popular year was 1997, when 4,791,668 persons visited the Park. Tourists visits fell off sharply at Sunset Crater, dropping from 488,911 in 1995 to just 175,805 in 1998. Visitation at Pipe Springs, while smaller in total, has been steadily increasing, however.

Given the fluctuating numbers discussed above, and the almost complete dependence of these locations on automobile travel and the availability of affordable gasoline, it is difficult to predict future visitation levels. While the overall trend is still upwards over the long term, the numbers in Table 2-2 do not reflect the devastating effect that the events of September 11, 2001, had on tourism nationwide and in Arizona.

LOCATION OF STATIONARY SOURCES

Potential stationary sources of particulates and air pollutants include electrical power plants, mining operations, and other industrial sites. More than a dozen facilities operate within or adjacent to Coconino County that emit significant amounts of Carbon Monoxide, Nitrogen Oxides, Volatile Organic Compounds, Sulfur Dioxide, PM_{10}, $PM_{2.5}$, or Ammonia. The Environmental Protection Agency monitors the activities of these stationary sources and tracks the tons of pollutants each generates annually. The latest data for these facilities—1999—is presented in Table 2-3, and the locations of the facilities are shown in Figure 2-3. The first column of Table 2-3 is a "Map Key" that lists numbers on Figure 2-3 that show the location of the facilities.

The site that produces the most emissions is the Navajo Generating Station. This facility emits almost six times as much total tons of emissions as the next largest source. The Navajo Generating Station is also the largest source of each of the pollutants with the exception of VOCs. One of the El Paso Natural Gas facilities east of Flagstaff produces nearly five times the VOCs that the Navajo facility emits. Details concerning the Navajo Generating Station follow.

Navajo Generating Station

The Navajo Generating Station, located at Page, Arizona, is a coal-fired, steam-electric generating station operated by Salt River Project. The ownership of the plant is apportioned as follows:

U.S. Bureau of Reclamation	24.3%
SRP	21.7%
Los Angeles Dept. of Water & Power	21.2%
Arizona Public Service Co.	14.0%
Nevada Power	11.3%
Tucson Electric Power	7.5%

The Navajo Generating Station serves electric customers in Arizona, Nevada, and California, and also supplies energy to pump water through the Central Arizona Project. The station can generate 2,250 megawatts from three 750-megawatt units, and consumes a maximum of 25,000 tons of coal per day with all units running at full load. [1]

Construction of the plant began in the early 1970s with the first unit producing electricity beginning in 1974. Operation of the other units began in 1975 and 1976. The complete facility cost approximately $650 million to construct, including $200 million in environmental-control equipment. An additional $420 million was spent on new scrubbers to remove contaminants from the exhaust stacks.

TABLE 2-1. PROFILE OF SELECTED COCONINO COUNTY SOCIOECONOMIC CHARACTERISTICS: 2000 - BY REGION

Subject	Flagstaff Region		Grand Canyon Region		Page		Sedona		Tuba City Region		Williams Region		Remainder of County		County Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Employment Status																
Population 16 years and over	45,750	100.00%	1,623	100.00%	4,973	100.00%	8,990	100.00%	5,588	100.00%	3,047	100.00%	25,996	100.00%	86,977	100.00%
In labor force	33,743	73.76%	1,486	91.56%	3,617	72.73%	5,167	57.47%	3,404	60.92%	2,043	67.05%	15,395	59.22%	59,688	68.63%
Armed Forces	25	0.05%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	16	0.53%	0	0.00%	41	0.05%
Civilian labor force	33,718	73.70%	1,486	91.56%	3,617	72.73%	5,167	57.47%	3,404	60.92%	2,027	66.52%	15,395	59.22%	59,647	68.58%
Employed	32,044	70.04%	1,438	88.60%	3,396	68.29%	4,917	54.69%	2,911	52.09%	1,913	62.78%	13,808	53.12%	55,510	63.82%
Unemployed	1,674	3.66%	48	2.96%	221	4.44%	250	2.78%	493	8.82%	114	3.74%	1,587	6.10%	4,137	4.76%
Not in labor force	12,007	26.24%	137	8.44%	1,356	27.27%	3,823	42.53%	2,184	39.08%	1,004	32.95%	10,601	40.78%	27,289	31.37%
Commuting to Work																
Workers 16 years and over	31,231	100.00%	1,421	100.00%	3,352	100.00%	4,825	100.00%	2,876	100.00%	1,903	100.00%	13,500	100.00%	54,283	100.00%
Car, truck, or van - - drove alone	21,917	70.18%	618	43.49%	2,443	72.88%	3,339	69.20%	1,615	56.15%	1,186	62.32%	9,163	67.87%	36,942	68.05%
Car, truck, or van - - carpooled	4,675	14.97%	141	9.92%	572	17.06%	426	8.83%	763	26.53%	334	17.55%	2,493	18.47%	8,978	16.54%
Public transportation (including taxicab)	185	0.59%	41	2.89%	29	0.87%		0.00%	4	0.14%	16	0.84%	101	0.75%	376	0.69%
Walked	2,060	6.60%	531	37.37%	147	4.39%	232	4.81%	390	13.56%	210	11.04%	779	5.77%	4,117	7.58%
Other means	1,276	4.09%	77	5.42%	103	3.07%	154	3.19%	45	1.56%	46	2.42%	245	1.81%	1,792	3.30%
Worked at home	1,118	3.58%	13	0.91%	58	1.73%	674	13.97%	59	2.05%	111	5.83%	719	5.33%	2,078	3.83%
Mean travel time to work (minutes)1	84				10		14								19	(X)
Vehicles Available per Household																
Occupied housing units	21,416	100.00%	864	100.00%	2,342	100.00%	4,937	100.00%	2,231	100.00%	1,535	100.00%	12,060	100.00%	40,448	100.00%
None	1,274	5.95%	103	11.92%	114	4.87%	161	3.26%	206	9.23%	114	7.43%	979	8.12%	2,790	6.90%
1	7,428	34.68%	395	45.72%	794	33.90%	1,811	36.68%	1,027	46.03%	463	30.16%	3,742	31.03%	13,849	34.20%
2	8,762	40.91%	289	33.45%	947	40.44%	2,183	44.22%	672	30.12%	546	35.57%	4,587	38.03%	15,803	39.10%
3 or more	3,902	18.22%	77	8.91%	487	20.79%	782	15.84%	326	14.61%	412	26.84%	2,802	23.23%	8,006	19.80%
House Heating Fuel																
Occupied housing units	21,416	100.00%	864	100.00%	2,342	100.00%	4,937	100.00%	2,231	100.00%	1,535	100.00%	12,060	100.00%	40,448	100.00%
Utility gas	17,440	81.43%	113	13.08%	623	26.60%	3,663	74.19%	210	9.41%	897	58.44%	3,025	25.08%	22,308	55.15%
Bottled, tank, or LP gas	918	4.29%	362	41.90%	170	7.26%	327	6.62%	934	41.86%	320	20.85%	3,529	29.26%	6,233	15.41%
Electricity	2,147	10.03%	254	29.40%	1,118	47.74%	838	16.97%	274	12.28%	127	8.27%	1,123	9.31%	5,043	12.47%
Fuel oil, kerosene, etc	69	0.32%	41	4.75%		0.00%		0.00%	11	0.49%	3	0.20%	87	0.72%	211	0.52%
Coal or coke	0	0.00%	0	0.00%		0.00%		0.00%	55	2.47%	0	0.00%	6	0.05%	61	0.15%
Wood	799	3.73%	89	10.30%	368	15.71%	7	0.14%	729	32.68%	177	11.53%	4,192	34.76%	6,354	15.71%
Solar energy	14	0.07%	0	0.00%		0.00%	8	0.16%	0	0.00%	7	0.46%	29	0.24%	50	0.12%
Other fuel	16	0.07%	5	0.58%	63	2.69%		0.00%	18	0.81%	2	0.13%	40	0.33%	144	0.36%
No fuel used	13	0.06%	0	0.00%		0.00%	31	0.63%	0	0.00%	2	0.13%	29	0.24%	44	0.11%

Source: U.S. Bureau of the Census, *Census 2000*.
[1]If the denominator of a mean value or per capita value is less than 30, then that value is calculated using a rounded aggregate in the numerator.
- Represents zero or rounds to zero. (X) = Not applicable.

TABLE 2-2. AREA NATIONAL PARK AND MONUMENT VISITATION

Year	Glen Canyon National Recreation Area	Grand Canyon National Park	Pipe Springs National Monument	Sunset Crater Volcano National Monument	Walnut Canyon National Monument	Wupatki National Monument
1981	1,733,529	2,472,270	30,008	353,815	83,098	183,448
1982	1,733,226	2,293,127	30,155	348,633	86,517	183,666
1983	1,873,031	2,248,082	28,237	375,136	88,376	190,938
1984	1,971,102	2,173,584	28,635	409,112	93,628	207,893
1985	2,078,866	2,711,529	30,083	412,501	90,077	191,950
1986	2,438,898	3,035,787	33,578	426,454	115,754	207,951
1987	2,858,739	3,513,030	35,648	449,423	109,001	208,953
1988	3,529,241	3,859,886	40,447	515,084	122,465	243,666
1989	3,452,847	3,966,209	42,287	499,265	135,129	245,948
1990	3,074,242	3,776,685	46,442	502,450	134,429	249,954
1991	3,181,144	3,886,031	55,271	520,487	157,146	234,122
1992	3,587,754	4,203,545	56,199	597,942	157,987	267,090
1993	3,584,158	4,575,602	52,436	514,943	165,223	262,769
1994	2,797,734	4,364,316	47,837	522,963	162,295	264,747
1995	2,511,353	4,557,645	46,423	488,911	149,082	262,675
1996	2,505,004	4,537,703	44,817	198,349	153,287	238,889
1997	2,430,781	4,791,668	66,624	187,734	129,807	233,582
1998	2,442,990	4,239,682	62,986	175,805	115,342	217,466

Source: National Park Service

TABLE 2-3. TONS OF AIR POLLUTANTS EMITTED ANNUALLY BY AREA INDUSTRIES (1999)

Map Key	County	Plant Name	SIC Code	Pollutant							Total Emissions
				VOC	NOx	CO	SO_2	PM_{10}	$PM_{2.5}$	NH_3	
1	Coconino	Intermountain Refining	2951	4.68	62.52	2.87	795.08				865.15
2	Coconino	Kaibab Forest Products	2421					31.61	12.06	0.06	31.67
3	Coconino	Navajo Generating Station	4911	232.59	35275.24	1939.23	9162.6	1886.1	855.69	2.66	48498.42
4	Coconino	Transwestern Pipeline	4922	62.29	1377.72	175.05	1.19	2.06	1.45		1618.31
5	Coconino	El Paso Natural Gas Co.	4922	1073.18	2812.01	378.05	0.56				4263.8
6	Coconino	Transwestern Pipeline	4922	14.49	619.53	533.29	0.14	2.29	1.61		1169.74
7	Coconino	El Paso Natural Gas Co.	4922	98.87	2450.12	316.8	0.38				2866.17
8	Coconino	Ralston Purina Company	2048	0.62	29.09	2.45	26.76	6.63	3.71		65.55
9	Coconino	Northern Arizona University	8221	0.41	54.51	5.08	0.08	0.44	0.41		60.52
10	Coconino	U. S. Army Navajo Depot	4911	0.16	2.98	0.65	1.28	0.14	0.05		5.21
11	Coconino	El Paso Natural Gas Co.	4922	161.18	7493.56	955.96	1.79				8612.49
12	Yavapai	El Paso Natural Gas Co.	4922		94.59		0.08				94.67
13	Yavapai	Chemical Lime Company	1499		1196.83	866.95	1404.61				3468.39
14	Yavapai	Phoenix Cement	3241		2648.31	296.85	407.83	157.58	52.9		3510.57
15	Gila	Payson Regional Medical Ctr.	4959		0.17	0.03		0.17	0.17		0.37

Source: U. S. Environmental Protection Agency, National Emission Trends database

FIGURE 2-1. LAND OWNERSHIP IN COCONINO COUNTY

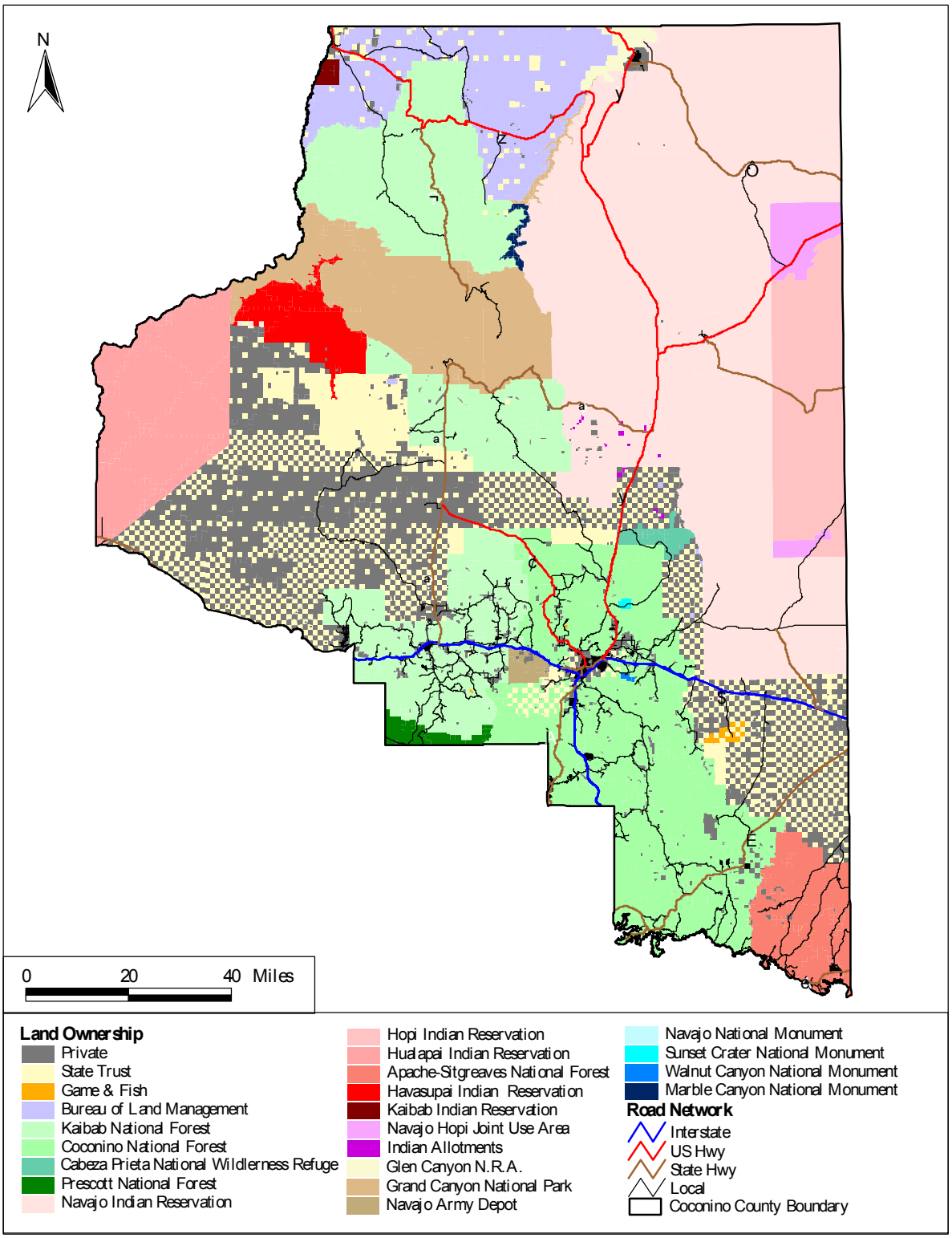


FIGURE 2-2. COCONINO COUNTY TRANSPORTATION SYSTEM

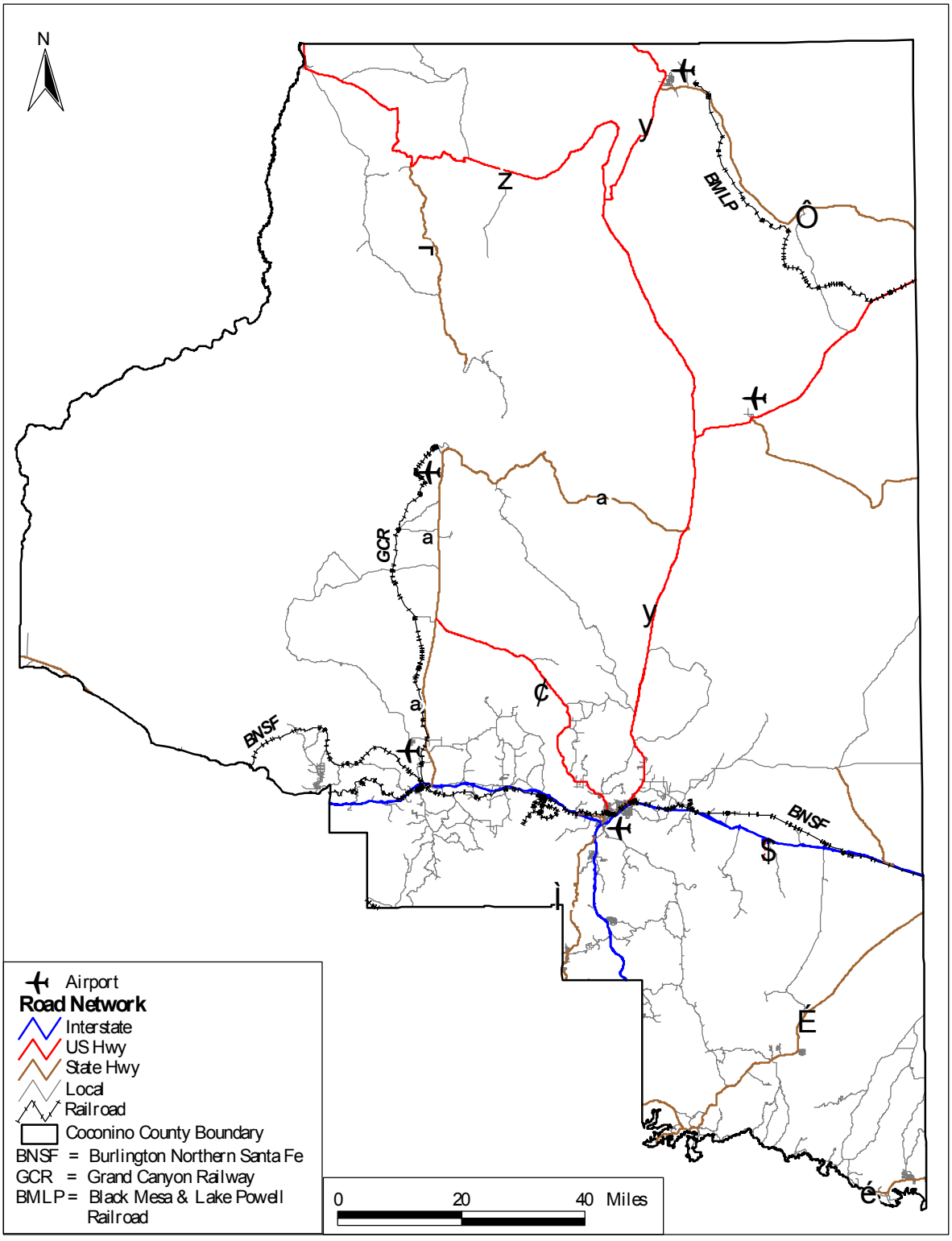
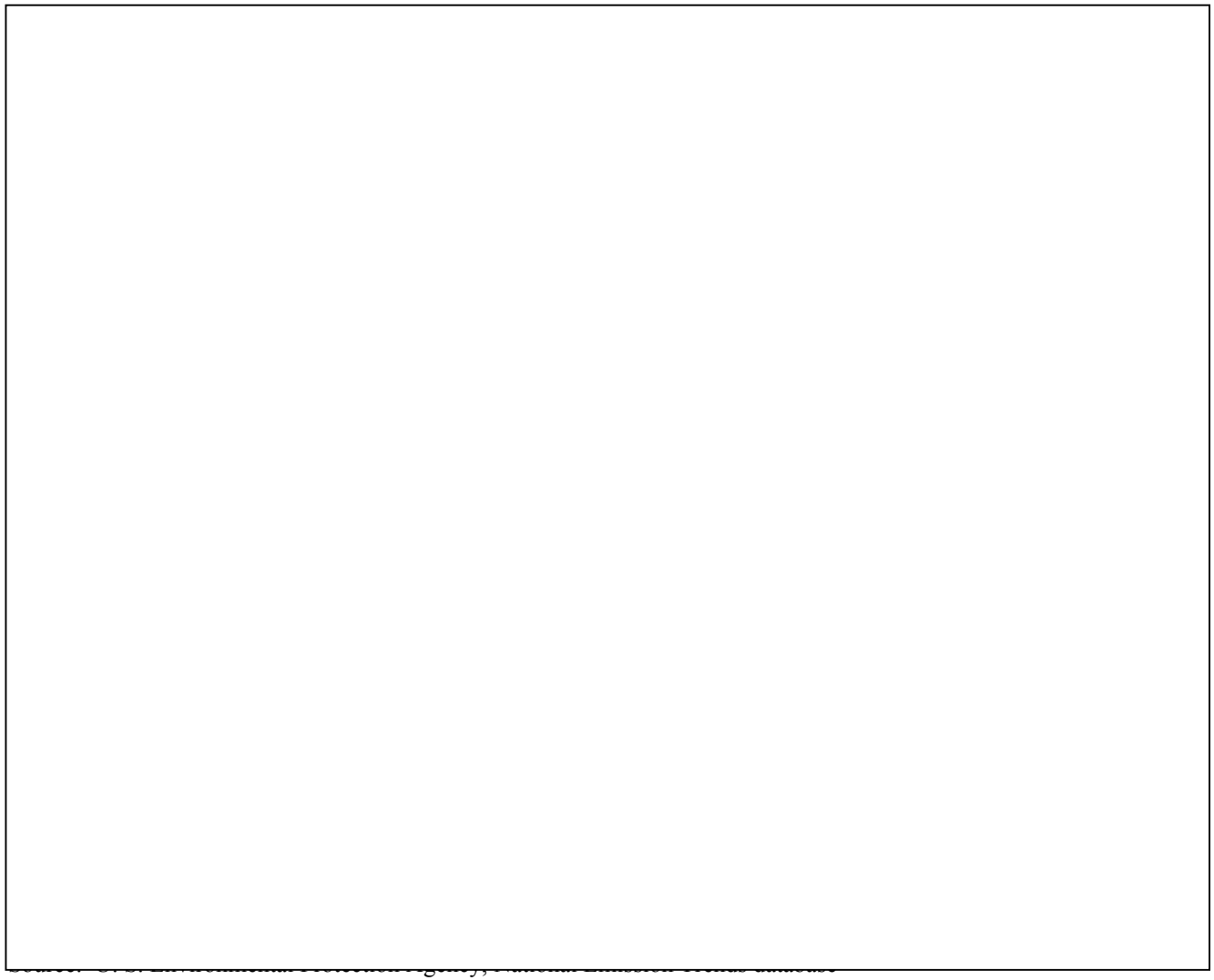


FIGURE 2-3. LOCATIONS OF INDUSTRIES EMITTING CO, NOx, VOC, SO_2, PM_{10}, $PM_{2.5}$, OR NH_3 IN OR NEAR COCONINO COUNTY



3. NATIONAL AND STATE AIR QUALITY CONSIDERATIONS

This Chapter discusses the characteristics and health impacts of air pollutants, summarizes federal air quality standards, visibility regulations, and ozone programs. The chapter includes a description of air pollution sources and trends from a national perspective. State air quality plans that address these requirements are also described. The chapter concludes with a discussion of the costs that may be avoided if the County remains in attainment of the national standards. The material presented here establishes the broader context for the Coconino County air quality data and issues presented in Chapter 4.

POLLUTANT CHARACTERISTICS AND HEALTH IMPACTS

In response to the Clean Air Act of 1977, the U.S. Environmental Protection Agency (EPA) established National Ambient Air Quality Standards (NAAQS) for six pollutants that can adversely affect human health and welfare. These six, called criteria pollutants, are carbon monoxide, lead, nitrogen dioxide, ozone, particulates, and sulfur dioxide. A discussion of the characteristics and potential health effects of each of these pollutants is provided below. The primary source for the information in this section on pollutant characteristics and health effects is the Air Quality Report of the Arizona Department of Environmental Quality, 2001 Annual Report.

Carbon Monoxide

Carbon monoxide (CO) is produced by the incomplete combustion of carbon in fossil fuels. Most carbon monoxide is emitted from tailpipes of on-road vehicles, a much smaller share by non-road engines, and most of the remainder is a by-product of commercial and residential heating. Peak concentrations typically occur along roadways and near intersections with high levels of traffic and congestion. Calm winds during the late fall and winter, coupled with night and morning ground-based temperature inversions, cause stagnant weather conditions that result in the buildup of carbon monoxide concentrations.

A colorless, odorless, and tasteless gas, CO interferes with the delivery of oxygen to human organs and tissues. Long exposure at high levels poses the greatest risk to those with cardiovascular disease, but healthy individuals may also experience dizziness, headaches, fatigue, and visual impairment from exposure to CO.

Lead

Lead is a toxic metal, which may be present in the air as a constituent of fine particles. In Arizona, lead emissions come from the smelting of ore and combustion of fossil fuels. Until 1987, most lead emissions were caused by alkyl lead compounds used as anti-knock additives in gasoline. With the phase-out of leaded gasoline, automotive emissions of lead have declined to nearly zero.

High-level exposure to lead in the atmosphere can damage human cardiovascular, renal, and nervous systems. Low-level exposure inhibits biosynthesis of blood hemoglobin, resulting in anemia. Pre-school children are most vulnerable to the effects of lead poisoning.

Nitrogen Dioxide

Nitrogen dioxide (NO_2) is a reddish-brown gas formed by the oxidation of nitric oxide, which is a by-product of fuel combustion. On-road vehicles, including diesel vehicles, heavy-duty gas trucks, and light duty gas vehicles, are a major source of NO_2 emissions. Non-road engines are also significant sources. NO_2 can also be emitted by point and area sources such as power plants, biogenic emissions from soils, and stationary combustion sources. Of special concern is the role that NO_2 plays in reduced visibility (i.e. it contributes the brownish color to urban haze) and in the photochemical formation of ozone.

At high exposure levels, NO_2 impairs the human respiratory system. However, community exposure studies for lower levels of NO_2 have not demonstrated significant linkages with respiratory symptoms or disease.

Ozone

Ozone in the upper atmosphere occurs naturally and protects life on earth from harmful ultraviolet radiation. In contrast, ground-level ozone is a poisonous, pungent-smelling gas. Ozone is not emitted by any source, but is formed by the photochemical reaction of volatile organic compounds (VOCs) and nitrogen oxides (NOx) in the presence of sunlight. Ground level ozone is the major constituent of smog. Peak concentrations of ozone typically occur in the summer, when ambient temperatures exceed 90 degrees Fahrenheit. On-road vehicles and non-road engines are major sources of the ozone precursors, VOC and NOx.

At ambient concentrations prevalent in many urban environments, ozone causes choking, coughing and irritated eyes. Prolonged exposure can lead to chest pain, headache, nasal congestion, and sore throat. At high concentrations ozone can damage lung tissue, aggravate respiratory disease, and make individuals more susceptible to respiratory infections. Children and those with existing lung disease are especially vulnerable. Ozone also reduces agricultural yields and increases tree and plant susceptibility to disease. On the basis of epidemiological evidence indicating that long exposures to high ozone concentrations are a higher risk, EPA promulgated a new eight-hour ozone standard in 1997 to replace the one-hour standard.

Particulates

Particulates are solid particles and liquid droplets that are small enough to remain airborne, such as dust, soil and soot. Particulates can be emitted directly from a source or be formed by gaseous emissions of sulfur dioxide (which can convert to sulfates), NOx (which can convert to nitrates) or VOCs (which can convert to organic carbon). The NAAQS address two particle sizes, PM_{10} (particulate matter less than 10 microns) and $PM_{2.5}$ (less than 2.5 microns). For comparison, a human hair is approximately 70-80 microns in thickness. The origin of most coarse particles (between 2.5 and 10 microns) is geologic, including re-entrained dust from paved and unpaved roads, and soil disturbed by earth-moving and construction activities. The fine particles (less than 2.5 microns) are usually emitted by combustion sources or formed by gases.

High PM_{10} concentrations can occur in any season or location, if there are sources of disturbed geologic material nearby and strong, gusty winds. $PM_{2.5}$ concentrations tend to peak in the central portions of urban areas during periods of poorest dispersion, generally, from sunset to mid-morning in the late fall and winter months.

Coarse particles, when inhaled, are deposited in the upper respiratory tract. Fine particles are deposited lower, in the pulmonary tissues, with some invading the alveoli of the lungs. These invasive particles decrease lung function and alter the body's defense systems. Sensitive groups include the elderly, asthmatics, and children. In 1995 the Arizona Comparative Environmental Risk Project ranked particulate matter as one of the highest environmental risks in the state. This conclusion was based on increased hospital admissions for respiratory problems, asthma, and lower and upper respiratory symptoms, due to high annual ambient PM_{10} concentrations during 1991. In addition, premature deaths due to PM_{10} in Arizona were estimated to approach 1,000 per year.[2]

Significant epidemiological research on the health effects of PM_{10} has been conducted in recent years. One frequently-cited paper summarizes the results of studies conducted in nine U.S. cities in the 1970s and 80s and in Sao Paulo, Brazil, in 1990-91.[3] When findings of the ten studies are averaged, mortality was found to increase by one percent for every 10 ug/m3 increase in PM_{10}, measured on a daily or multi-day basis. The same paper summarizes studies on morbidity and concludes that elevated PM_{10} levels decrease lung function and increase asthma attacks, hospital admissions for respiratory disease, and emergency room visits. The PM_{10} mortality and morbidity rates derived from this paper are summarized in Table 3-1.

Sulfur Dioxide

Sulfur dioxide is an invisible gas that can have a pungent odor at high concentrations. In Arizona the principal source of sulfur dioxide emissions has been the smelting of sulfide copper ore. Major controls were installed in copper smelters in the 1980s, reducing sulfur dioxide emissions dramatically. Sulfur dioxide and sulfate emissions from motor vehicles have also declined, due to reductions in the sulfur content of diesel fuel and gasoline.

Exposure to sulfur dioxide alters the function of the upper airways causing wheezing, shortness of breath, and coughing. Sulfur dioxide also aggravates asthmatics. Other individuals who are especially vulnerable include the elderly, children, and those with bronchitis and emphysema.

NATIONAL AMBIENT AIR QUALITY STANDARDS

The National Ambient Air Quality Standards for the six criteria pollutants are identified in Table 3-2. New standards for ozone (eight-hour) and $PM_{2.5}$ were promulgated by EPA in July 1997. These were subjected to a legal challenge (in *American Trucking Association vs. EPA*), but were subsequently upheld by the U.S. Court of Appeals for the D.C. Circuit, as well as the U.S. Supreme Court. The EPA is currently developing implementation guidance for these two new standards.

EPA VISIBILITY REGULATIONS

Section 169A of the Clean Air Act sets a national goal of reducing visibility impairment at parks and wilderness areas, such as the Grand Canyon. EPA's Regional Haze Regulations, published on July 1, 1999, were developed to protect visibility on the cleanest days and improve visibility on the haziest days in the country's 156 national parks and large wilderness areas, called mandatory Federal Class I areas. The regulations provide guidelines for achieving natural visibility conditions at Class I areas by the year 2064.

As a first step toward achieving this goal, in 1991 Congress created the Grand Canyon Visibility Transport Commission (GCVTC) to advise EPA on strategies to protect visual air quality at national parks and wilderness areas on the Colorado Plateau.

EPA OZONE PROGRAMS

The Environmental Protection Agency offers several programs that allow regions to avoid or delay nonattainment designations for ozone. Ozone Flex is a program that allows areas to avoid one-hour ozone nonattainment designations—or being "bumped up" to more severe ozone classifications—by implementing voluntary control measures. The Early Action Compact allows an area to commit to early, voluntary actions in exchange for a delay in the effective date for a nonattainment designation. An area must be designated an attainment area for one-hour ozone in order to qualify for either of these programs.

Ozone Flex

This program was first implemented in Tulsa, Oklahoma, in 1995. As a Flexible Attainment Region, Tulsa was able to implement voluntary measures suitable to the region's economy, meteorology, geography and travel behavior, rather than federally-mandated controls (i.e. inspection/maintenance and vapor recovery). An important feature of ozone flex is that

Tulsa avoided being designated a nonattainment area for the one-hour standard, even though exceedances of this standard occurred after 1995. Participation in an ozone flex program minimizes the risk that future violations of the ozone standards will occur and if violations of the one-hour standard do occur, protects the area from being designated nonattainment or "bumped up" for up to five years. Pinal County is planning to participate in the ozone flex program. They will be notifying EPA of their intent to participate by December of 2002.

8-Hour Ozone Early Action Compact

Areas that currently approach or monitor exceedances of the 8-hour ozone standard, but are currently designated an attainment area for the one-hour ozone standard, may wish to participate in an 8-Hour Ozone Early Action Compact. On June 19, 2002, the EPA Administrator for Region 6 approved the first Compact with the Texas Natural Resource Conservation Commission and encouraged other areas to participate. The purpose of the Compact is to achieve reductions in eight-hour ozone concentrations faster than required by the Clean Air Act. Unlike Ozone Flex, the Compact requires a formal revision to the state implementation plan (SIP) and state and/or local agencies must make commitments to implement control measures that are legally-binding. These measures can be voluntary, although no more than 3 percent in emission reductions can be credited to voluntary stationary source measures and no more than 3 percent, to mobile source measures. The plan must demonstrate, through modeling, that the eight-hour ozone standard will be met by 2007. In exchange for early implementation of control measures, if the area does violate the eight-hour ozone standard, EPA will delay the effective date for the nonattainment designation. The SIP must be submitted by 2004 and measures implemented by the ozone season in 2005 in order to qualify for the benefits of this program. Maricopa County is considering participation in the Ozone Compact Program.

STATE AIR QUALITY PLANNING

The Arizona Department of Environmental Quality (ADEQ), in cooperation with county and local agencies, prepares air quality plans for most areas of the state, except Phoenix and Tucson. In these larger urban areas, lead responsibility for preparing air quality plans is vested in the metropolitan planning organizations (MPOs). The MPOs work closely with ADEQ, counties, and local jurisdictions in developing nonattainment and maintenance plans. Air quality plans developed to meet requirements of the Clean Air Act become revisions to the SIP. The objective of these plans is to demonstrate attainment and maintenance of the NAAQS through implementation of federal, state, and local control measures. Responsibility for implementation rests with the state, counties, MPOs, and local agencies that have committed to implement the control measures in the plans. All commitments in the SIP are legally binding. The ADEQ submits nonattainment and maintenance plans and other required SIP elements (i.e. requests for redesignation to attainment, legal authority for control measures) to EPA for approval. If a required plan or SIP element is not submitted on time or is disapproved, EPA may impose sanctions on new industrial sources (two-for-one offsets) and federal transportation funding.

Nonattainment and Maintenance Areas

There are currently fourteen areas in Arizona, shown in Table 3-3, that have been designated by EPA as nonattainment or maintenance areas for carbon monoxide, ozone (one-hour standard), PM_{10}, or sulfur dioxide. Over the next several years, EPA may designate additional nonattainment areas in Arizona, based on the new eight-hour ozone and $PM_{2.5}$ standards.

None of the currently designated nonattainment areas is located in Coconino County. Payson is the area closest to Coconino County that did, at one time, violate the PM_{10} standards. On June 26, 2002, EPA proposed to approve the moderate area nonattainment and maintenance plans for Payson and re-designate the area to attainment of the PM_{10} standards.

Payson PM_{10} Maintenance Area

As a result of EPA's recent redesignation to attainment, a 144-square mile area surrounding and including Payson is now classified as a PM_{10} maintenance area. The PM_{10} monitoring data for Payson has not shown a violation of the daily or annual PM_{10} standard since 1991. The 2002 Limited Maintenance Plan submitted to EPA by ADEQ attributes Payson's attainment of the PM_{10} standards to the following measures:

1. In 1992, ADOT installed two miles of curb and gutter on Highway 87 from the intersection with Highway 260 to Roundup Road.
2. In 1992, ADOT paved five miles of unpaved shoulders on Highways 87 and 260 when these facilities were widened to four lanes.
3. Since 1990, the Town of Payson has paved four miles of unpaved roads.
4. Gila County paved nearly 18 miles of unpaved roads between 1989 and 2000.
5. Arizona Administrative Code R18-2-607 requires control of storage piles to minimize fugitive emissions. (This law requires reasonable precautions, such as chemical stabilization, wetting or covering to prevent excessive dust from becoming airborne.)
6. In 1988, EPA implemented New Source Performance Standards for wood stoves. (In 1995, the Town of Payson passed an ordinance prohibiting sale or installation of wood stoves that do not meet EPA Phase II standards).
7. The Town of Payson implemented an ordinance requiring the paving of commercial parking facilities and paving of unpaved roads as a condition of minor land divisions.
8. Kaibab Industries' lumber/sawmill operation closed and the facility was dismantled in June 1993.
9. Lewis M. Pyle Memorial Hospital's medical waste incinerator was shutdown and removed in 1993.
10. Smoke management plan requirements were implemented by the U.S. Forest Service, Bureau of Land Management, and Arizona State Land Department, in cooperation with ADEQ.

The Payson Limited Maintenance Plan also identifies contingency measures that will be considered for implementation in the future, if monitored values exceed 65 percent of the 24-hour standard (98 μg/m3) or 90 percent of the annual standard (40 μg/m3). Potential ADEQ contingency measures include lowering opacity limits from 40 percent to 20 percent, reviewing permits on stationary sources, and strengthening woodburning and material storage pile requirements. Contingency actions on the part of the Town of Payson and/or Gila County might include paving or stabilizing public unpaved roads, vacant lots or unpaved parking lots. In addition, the Payson wood stoves ordinance passed in 1995 contains a contingency provision: if a PM_{10} violation occurs, new fireplaces installed in all residences will have to be EPA Phase II-approved (i.e., wood stove inserts, gas logs). This requirement would take effect within forty-five days after EPA notification that a violation had occurred. [4]

Regional Haze

The State of Arizona has also been actively involved in visibility and regional haze issues, beginning with participation in the Grand Canyon Visibility Transport Commission (GCVTC) in 1991 and continuing with the Western Regional Air Partnership, the successor organization to the GCVTC. The GCVTC was created by Congress to comply with Section 169B(f) of the Clean Air Act. Arizona Governor Symington was the chairman of the GCVTC when its final report, *Recommendations for Improving Western Vistas*, was published on June 10, 1996.

One of the recommendations of the GCVTC was to establish a regional coordinating entity to continue its work. This entity, the Western Regional Air Partnership (WRAP), was formed in 1997. The WRAP is funded by the Western Governors' Association and has a current membership of 15 Western states. The Partnership committees are comprised primarily of representatives from federal agencies: EPA, National Park Service, U.S. Forest Service; state air quality agencies; utilities; and environmental groups.

The 1999 EPA Regional Haze Regulations require Arizona to develop a SIP revision to control emissions from anthropogenic sources that contribute to visibility impairment at the Class I areas in Arizona. The twelve Class I areas in Arizona are shown in Figure 3-1.

In August-November 2001, ADEQ conducted a stakeholder process to provide advice on developing a regional haze SIP. The stakeholders recommended that ADEQ prepare a SIP under Section 309 of the EPA Regional Haze Regulations. Section 309 is based on the recommendations of the 1996 GCVTC report. House Bill 2585, passed by the Arizona Legislature in 2002, provides ADEQ with the authority to submit a Regional Haze SIP. In June 2002 ADEQ formed advisory committees and working groups and began dedicating consultants and support staff to assist in developing SIP products. Under Section 309, the SIP must be submitted to EPA by December 31, 2003. To the extent possible, the Arizona SIP will rely on emission inventories, modeling, templates, and other products being developed by the Western Regional Air Partnership.

Smoke Management Program

Prescribed burning is used to clear logged areas, reduce fire hazards, control disease and excess vegetation, and improve wildlife habitats. If not properly managed, prescribed burning can produce smoke that is a nuisance to neighbors and affects public health. Smoke can also reduce visibility, creating hazardous conditions on roads and near airports, and obscuring natural, scenic vistas at national parks and wilderness areas.[5]

The Arizona Department of Environmental Quality conducts a smoke management program to minimize the adverse effects of prescribed burning. All "burners" must submit a detailed plan to the ADEQ Smoke Management Team describing the location, duration and size of the burn; the amount, size, concentration and type of fuel to be burned; and the expected direction of smoke transport. The Smoke Management Team reviews burn permit requests, forecasted weather conditions, and other burn activity in the vicinity and either approves, limits the area of the burn, or denies the request. Ultimately, the "burner" remains responsible for ensuring that conditions are conducive to smoke dispersion, before ignition occurs.

SOURCES OF AIR POLLUTION

In general, the sources of emissions contributing to formation of the six criteria pollutants and regional haze can be grouped into five major categories: on-road vehicles, non-road engines, point sources, area sources, and miscellaneous sources.

On-road vehicles are powered by gasoline and diesel fuel and include automobiles, light duty trucks, heavy-duty trucks, buses, and motorcycles. This category represents a significant source of carbon monoxide, nitrogen oxide, volatile organic compound, and particulate emissions.

Non-road engines include lawn and garden equipment, construction equipment, farm equipment, off-road vehicles, aircraft, and trains. This source is a smaller, but growing source of carbon monoxide, nitrogen oxides, volatile organic compounds, and particulate emissions.

Point sources include large industrial operations such as electric utilities, manufacturing plants, metals processing facilities, chemical plants, and mines. Sulfur dioxide and lead are emitted primarily by point sources. Industrial processes can also be a major contributor of volatile organic compounds. Other criteria pollutants or precursors may be emitted by a point source depending upon the type of industrial operation.

Area sources are emission-producing activities conducted over a broad and variable geographic area, such as painting, dry cleaning, construction activity, and wood combustion. Area sources tend to be a major source of volatile organic compounds and particulates. One

or more of the other criteria pollutants or precursors may also be emitted by an area source depending upon the type of activity.

Miscellaneous sources include forest fires, agricultural fires, and wind blown dust. These three miscellaneous sources emit particulates and also contribute to hazy conditions.

NATIONAL AIR POLLUTION TRENDS

On a national level, concentrations of carbon monoxide, lead, ozone and PM_{10} have declined since 1981, as shown in Table 3-4. These reductions, ranging from 19 percent for PM_{10} to 93 percent for lead, represent average declines across the country. Although all of these pollutants, as well as sulfur dioxide, have decreased, individual urban areas may have experienced different reductions, depending on the type and number of industrial sources, population and economic growth rates, age of the vehicle fleet, climate, altitude, and stringency of air pollution controls.

Despite these variations, Figure 3-2 illustrates that reductions in the criteria pollutants have occurred in urban areas throughout the U.S. The Pollutant Standards Index (PSI) measures the number of days when at least one criteria pollutant exceeded the standard. Overall, total PSI days in the U.S. declined by 69 percent between 1991 and 1996.

Since the Clean Air Act was passed in 1970, carbon monoxide (CO), volatile organic compounds (VOCs), and PM_{10} emissions have declined for point, area, and on-road mobile sources, but not non-road engines, as shown in Figure 3-3. For on-road vehicles, oxides of nitrogen have increased slightly, while other pollutants have declined significantly. These decreases have occurred at the same time U.S. population and employment have increased by 33 percent and 68 percent, respectively, and vehicle miles of travel and gross domestic product (GDP) have more than doubled (see Figure 3-4).

On-road vehicle emission reductions have resulted primarily from catalytic converter and electronic fuel control technologies in new cars and use of reformulated fuels. Despite these reductions, on-road vehicles continue to contribute more than half of the carbon monoxide and PM_{10} emissions and about one third of the ozone precursors, volatile organic compounds and nitrogen oxides.

Because late model cars are so much cleaner, older and poorly tuned vehicles are now contributing a large share of the on-road vehicle emissions. Nationally, less than 10 percent of the vehicles on the road emit more approximately 50 percent of the VOCs. These are called high emitters (i.e. emitting more than twice the standard). The dirtiest one percent of the vehicles contribute about 25 percent of the VOCs. These are considered the super-high emitters (i.e. emitting more than 10 grams/mile).

To demonstrate how clean new cars have become relative to non-road engines, a 1998 model year automobile would have to travel 660 miles to emit the same amount of VOCs as one-

hour of typical chainsaw use. The same vehicle would have to travel 305 miles to produce equivalent CO emissions.

Figure 3-3 indicates that non-road engine emissions of CO and nitrogen oxides (NOx) have more than doubled since 1970, while VOCs have increased by 70 percent. To address this lack of progress in controlling emissions from non-road engines, EPA promulgated stricter emission standards for these sources in 1997. These standards have decreased VOC emissions from the controlled equipment by 32 percent. EPA has also set standards for small engines such as lawnmowers, garden tractors, leaf blowers, and chainsaws. These standards are scheduled to phase-in between 2001 and 2007 and are expected to reduce VOC and NOx emissions from this equipment by 60-70 percent.

In summary, the following observations can be derived from the national air quality trends:

- Measured concentrations of all criteria pollutants, except nitrogen dioxide, have declined over the last twenty years. [6]
- Emissions from on-road vehicles have declined across the U.S., despite significant increases in population, employment, GDP and vehicle travel.
- A small proportion of older, poorly-tuned vehicles produce the greatest share of tailpipe emissions.
- Non-road engines are the only source category for which emissions have increased since 1970. Efforts are being made at the federal level to impose stricter emission standards on this source.
- On-road vehicles continue to represent a significant source of carbon monoxide, volatile organic compounds, nitrogen oxides and PM_{10} emissions.

COSTS OF BECOMING A NONATTAINMENT AREA

An area is designated "nonattainment" if it violates the NAAQS for one or more pollutant. The EPA makes this designation on the basis of multiple years of air quality monitoring data that show a standard is consistently violated. Nonattainment areas boundaries sometimes follow political boundaries (i.e. counties) or may be delineated on the basis of other factors (i.e. census urbanized areas), agreed upon by the Governor and EPA.

A nonattainment area may be classified as marginal, moderate, serious, severe, or extreme, depending upon the pollutant and the severity of the NAAQS violations. Maricopa County is classified as a "Serious" nonattainment area for carbon monoxide, ozone and PM_{10}. This classification impacts the complexity of the planning requirements, the attainment dates, and stringency of the control measures required to attain the standards. Once air quality monitoring data over a number of consecutive years indicates that the standards are no longer violated and nonattainment and maintenance plans for the area have been approved by EPA, a nonattainment area can be redesignated to a "maintenance area." Tucson, for example, is now a maintenance area for carbon monoxide and Payson is a maintenance area for PM_{10}.

U.S. Department of Transportation regulations require that all transportation plans and programs in a nonattainment or maintenance area conform with the state air quality plan, called a State Implementation Plan or SIP. This requirement is called "transportation conformity." The Arizona SIP is maintained by the Arizona Department of Environmental Quality and represents a composite of air quality plans addressing pollutants and sources throughout the state.

The purpose of federal transportation conformity requirements is to ensure that transportation activities do not worsen air quality or interfere with attaining the NAAQS. The requirements also promote implementation and funding of transportation control measures that improve air quality, such as traffic signal synchronization, street intersection improvements, carpools, and transit services.

Coconino County does not violate the NAAQS and therefore is in attainment of the federal standards for the six criteria pollutants. Since Coconino County is not designated as a nonattainment or maintenance area, the transportation conformity requirements do not currently apply to the Flagstaff MPO.

Pima County does not currently violate the NAAQS either, but is concerned that it may violate the eight-hour ozone standard within the next few years. In 1999, the Pima Association of Governments (PAG), in cooperation with the Pima County Department of Environmental Quality, performed a study to evaluate the cost of ozone nonattainment. An article summarizing the study states:

> In general, if a community is designated as a nonattainment area, it is required to take prescribed steps to reduce ambient levels of air pollutants to meet the NAAQS. The process is usually accomplished through the development of a State Implementation Plan (SIP) which outlines strategies the community will take to achieve clean air. These strategies…typically require pollution controls to be applied to various industrial facilities and businesses, government operations, and a wide range of consumer activities. Moreover, the administrative costs of developing, implementing and enforcing a SIP can be substantial. In theory, if a community acts before a violation of air quality standards has occurred, then the most cost-effective controls could be selectively implemented, and much of the administrative burden avoided. [8]

The PAG study concluded that the total primary, secondary and macroeconomic costs of becoming a nonattainment area for ozone would be $30-$50 million per year. A breakdown of these costs is shown in Table 3-5. To avoid future violations of the eight-hour ozone standard and the attendant costs, Pima County is considering proactive steps to reduce precursor emissions of volatile organic compounds and nitrogen oxides.

The same PAG study estimated that the health costs (i.e. physician care, restricted activity, lost workdays, hospital admissions, and loss of life) of an increase in ozone from .08 to .085 ppm were $2-$8 million per year. Since the population of Coconino County is approximately 15 percent of the population of Pima County, it is reasonable to assume that an ozone increase of a similar magnitude in Coconino County would incur health costs of $300,000 to $1.2 million annually.

Like Pima County, ozone concentrations in Coconino County could rise during the next several years, before the benefits of federal Tier 2 and heavy-duty controls begin to take effect. As noted in the first section of this chapter, the monitor located at the South Rim of the Grand Canyon typically records peak eight-hour ozone concentrations in the summer of about 90 percent of the standard, while the Page monitor is at 80 percent of the standard. Any pre-emptive efforts to reduce ozone will help Coconino County save lives and avoid the potential costs of nonattainment. In addition, reducing particulates and ozone will contribute to improved visibility in Flagstaff, the Grand Canyon and other Class I areas on the Colorado Plateau.

TABLE 3-1. MEDICAL DATA FOR PM_{10}

For every 10 μg/m3 increase in PM_{10}, measured on a daily or multi-day basis:	
Mortality:	+1.0%
Morbidity	
Asthma:	+3.0%
Hospital Admissions for Respiratory Disease:	+ 1.2%
Emergency Room Visits:	+1.0%
FEV-1 (lung function):	0.3%

Source: Pope, Dockery and Schwartz, *Review of Epidemiological Evidence of Health Effects of Particulate Air Pollution*, April 28, 1994.

TABLE 3-2. NATIONAL AMBIENT AIR QUALITY STANDARDS

Primary Standards To Protect Public Health		
Carbon Monoxide	One hour Eight hour	35 ppm 9 ppm
Lead	Quarter	1.5 $\mu g/m^3$
Nitrogen Dioxide	Annual	100 $\mu g/m^3$
Ozone	One hour Eight hour	.12 ppm .08 ppm
PM_{10}	24-hour Annual	50 $\mu g/m^3$ 150 $\mu g/m^3$
$PM_{2.5}$	24-hour Annual	65 $\mu g/m^3$ 15 $\mu g/m^3$
Sulfur Dioxide	24-hour Annual	.14 ppm .03 ppm

Source: Arizona Department of Environmental Quality, *2001 Annual Report*, Air Quality Reports.

TABLE 3-3. NONATTAINMENT AND MAINTENANCE AREAS IN ARIZONA

Area	Pollutant	Designation	Status
Ajo	PM_{10}	Nonattainment (Moderate)	No exceedances at the monitor; maintenance plan/redesignation request to be submitted in 2002
	SO2	Nonattainment	Copper smelter dismantled in 1995; maintenance plan/redesignation request to be submitted in 2002
Bullhead City	PM_{10}	Maintenance (Pending)	Maintenance plan/redesignation request submitted to EPA in 2/02
Douglas	PM_{10}	Nonattainment (Moderate)	No exceedances at the monitor; attainment SIP submitted in 1993
	SO2	Nonattainment	Copper smelter dismantled in 1995; maintenance plan/redesignation request submitted to EPA in 12/01
Hayden	PM_{10}	Nonattainment (Moderate)	No exceedances at the monitor; attainment SIP submitted in 1989
	SO2	Nonattainment	Maintenance plan/redesignation request to be submitted in 2002
Miami	SO2	Nonattainment	Maintenance plan/redesignation request to be submitted in 2002
Morenci	SO2	Nonattainment	Copper smelter dismantled in 1995; maintenance plan/redesignation request to be submitted in 2002
Nogales	PM_{10}	Nonattainment (Moderate)	No exceedances at monitor since 1999; attainment SIP submitted in 1993
Paul Spur	PM_{10}	Nonattainment (Moderate)	No exceedances at the monitor since1997; maintenance plan/redesignation request to be submitted in 2002
Payson	PM_{10}	Maintenance	Redesignation to attainment proposed for approval on 6/26/02
Phoenix	PM_{10}	Nonattainment (Serious)	Nonattainment plan submitted in Feb 2000; approved on 07/25/02
	CO	Nonattainment (Serious)	One exceedance at monitor since 1996; nonattainment plan submitted on 4/18/01; maintenance plan/redesignation request to be submitted in 2003
	O3	Nonattainment (Serious)	No exceedances at monitor since 1996; attainment SIP submitted in 12/01; maintenance plan/ redesignation request to be submitted in 2003
Rillito	PM_{10}	Nonattainment (Moderate)	No exceedances at monitor since 1989; attainment SIP submitted in 1994
San Manuel	SO2	Nonattainment	Maintenance plan/redesignation request to be submitted in 2002
Tucson	CO	Maintenance	No exceedances at monitor since 1984; Redesignated to attainment on 4/25/00
Yuma	PM_{10}	Nonattainment (Moderate)	No exceedances at monitor since 1991; maintenance plan/redesignation request to be submitted in late 2003

Source: www.adeq.state.az.us/environ/air/plan/non.html

TABLE 3-4. CHANGES IN AIR POLLUTION CONCENTRATIONS

Pollutant	Change in Concentrations 1981-2000
Carbon Monoxide	-61%
Lead	-93%
Ozone (one-hour)	-21%
PM_{10} *	-19%

Source: FHWA, Transportation Air Quality, Selected Facts and Figures, January 1999.

*PM_{10} changes are calculated for 1985 to 1999.

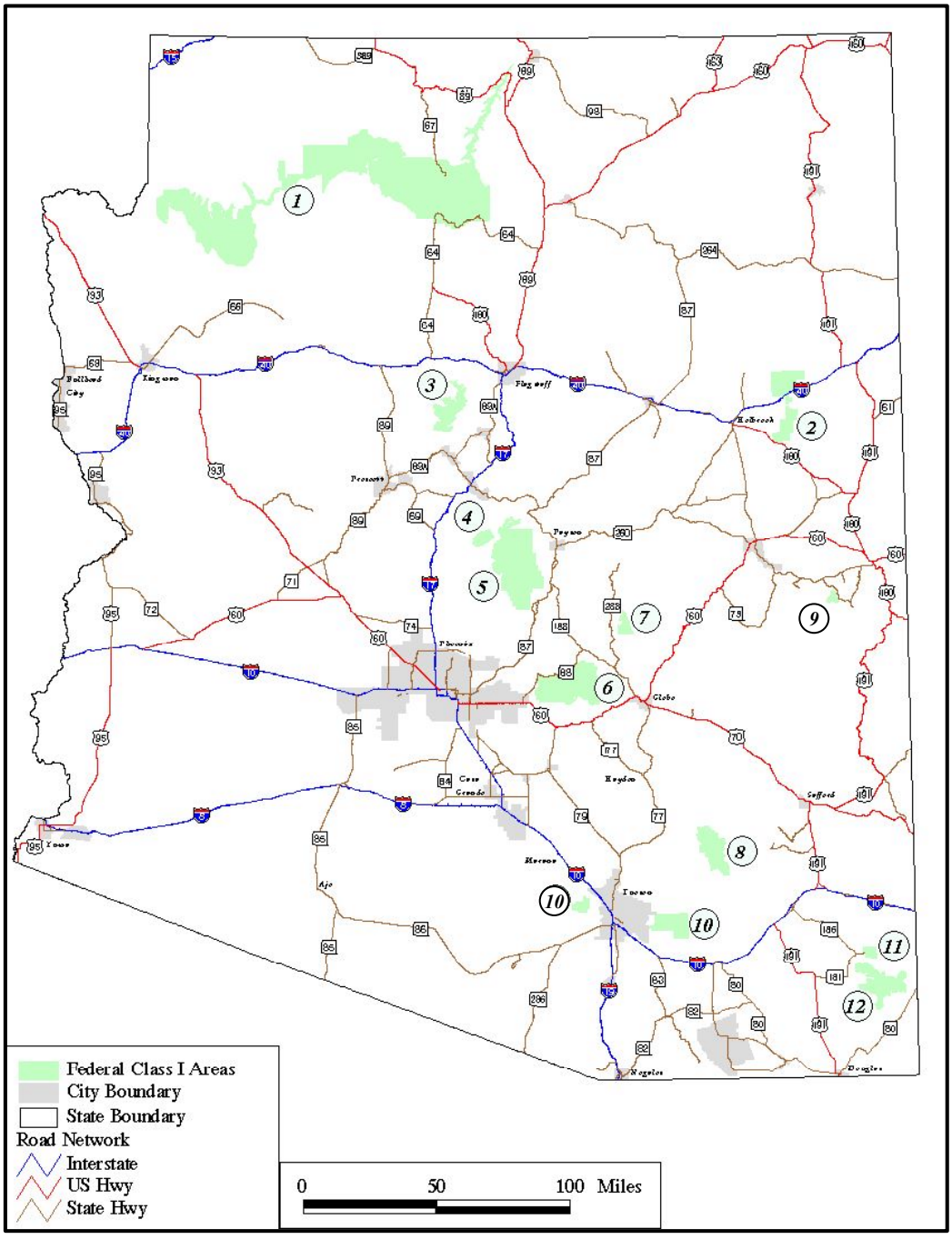
TABLE 3-5. COST OF BECOMING A NONATTAINMENT AREA FOR THE 8-HOUR OZONE STANDARD IN PIMA COUNTY

Type of Costs	Total Cost* ($ million per year)
Administrative	
PAG	0.6-0.8
PDEQ	0.3-0.4
State Agencies	0.3-0.6
Stationary Source Controls	8.4-19.6
Mobile Source Controls	
Stage II Vapor Recovery	6.8-10.0
Enhanced I/M	14.6-19.4
Health Effects	0.5-4.0
Total	$31.5-54.8

Source: Keyes, et. al., "Estimating the Costs of Violating Air Quality Standards," *Air and Waste Management Journal*, April 2001.

*Includes primary, secondary, and macroeconomic costs

FIGURE 3-1. ARIZONA CLASS I AREAS



1. Grand Canyon NP
2. Petrified Forest NP
3. Sycamore Canyon
4. Pine Mountain Wilderness
5. Mazatzal Wilderness
6. Superstition Wilderness
7. Sierra Ancha Wilderness
8. Galiuro Wilderness
9. Mount Baldy Wilderness
10. Saguaro NP
11. Chiricahua NM
12. Chiricahua Wilderness

FIGURE 3-2. COMPARISON OF POLLUTANT STANDARDS INDEX (PSI) DAYS

Source: *Transportation Air Quality Facts and Figures*, Federal Highway Administration, 1999

FIGURE 3-3. CHANGES IN EMISSIONS BY SOURCE CATEGORY, 1970-1999

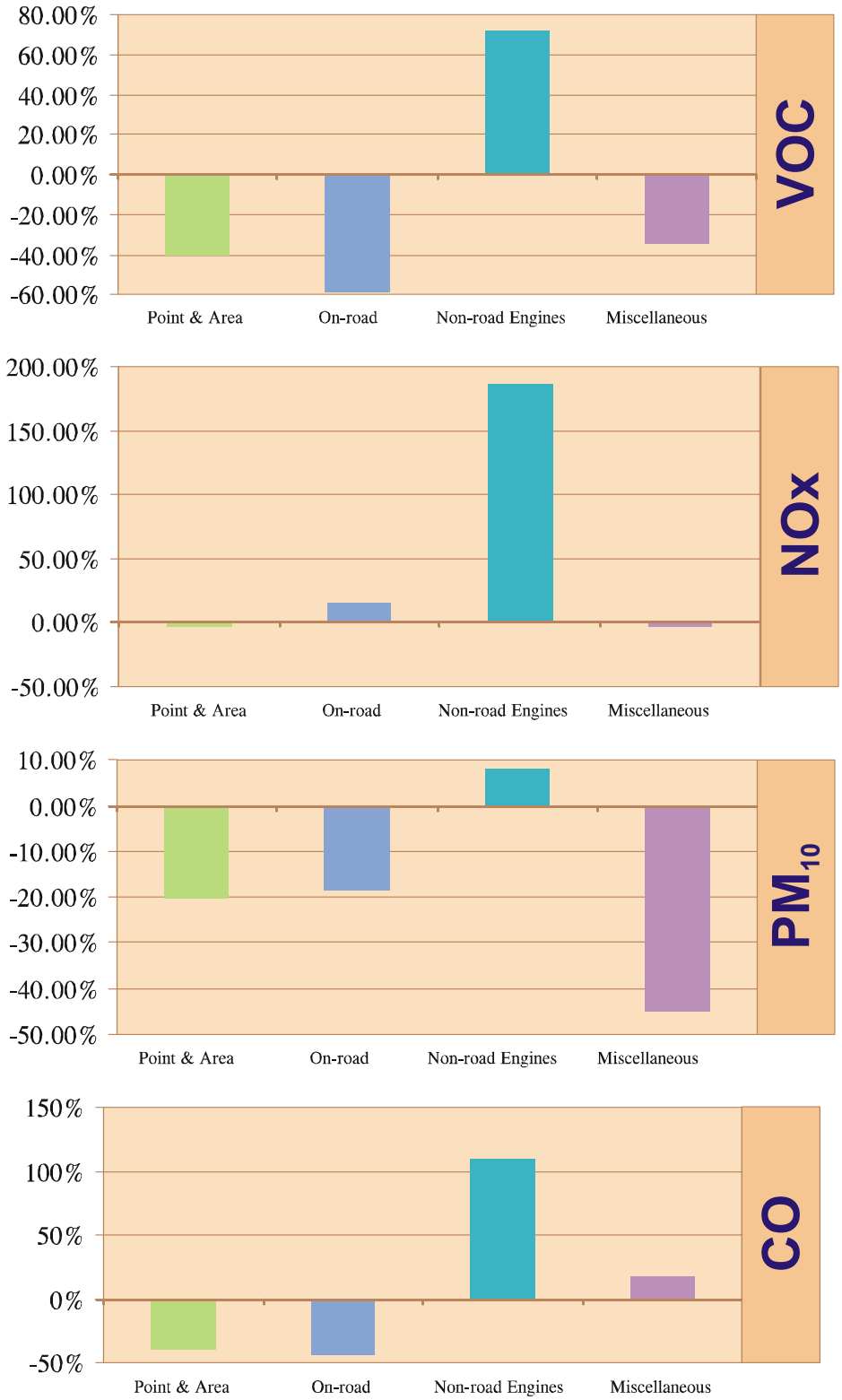
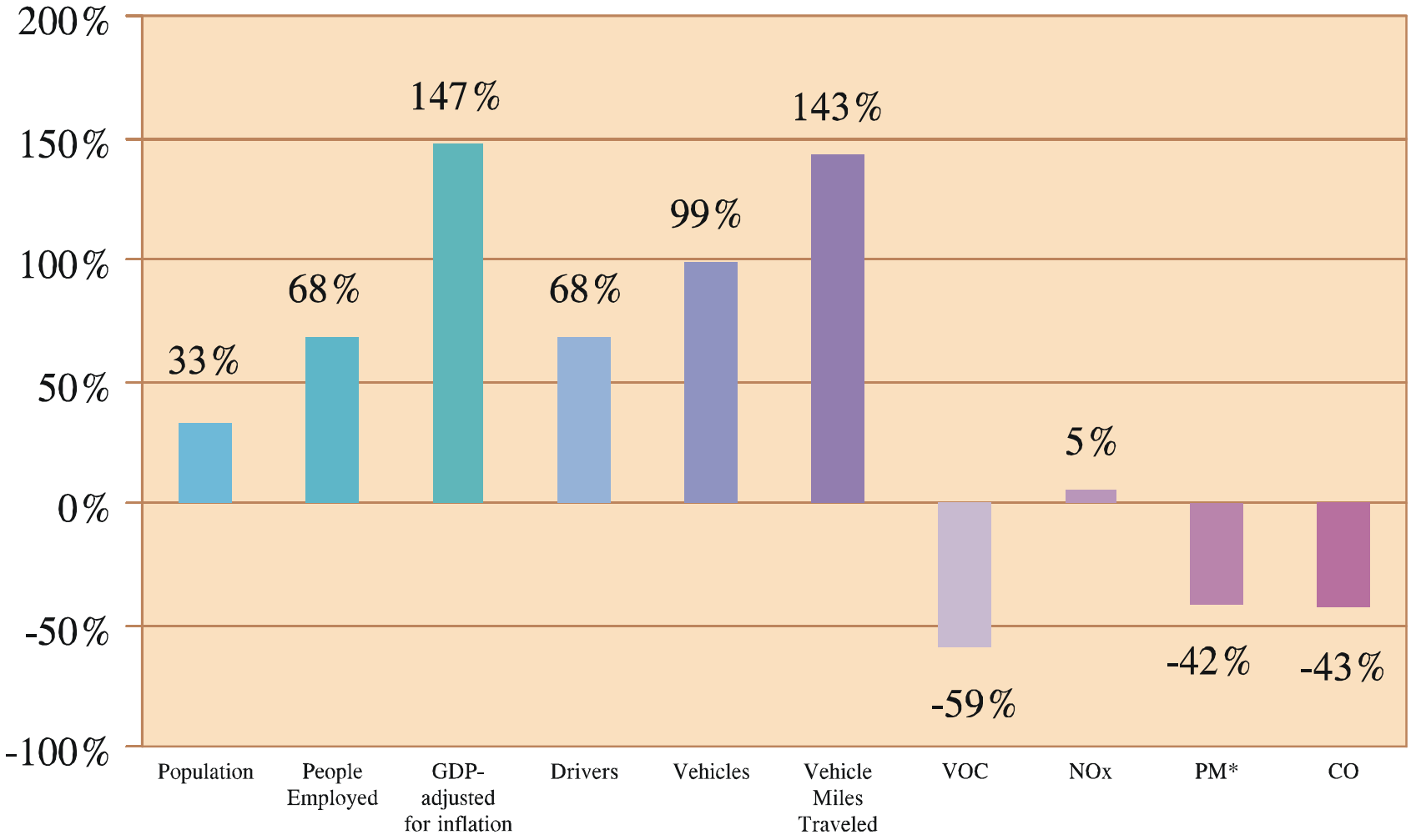


FIGURE 3-4. CHANGE IN ON-ROAD VEHICLE EMISSIONS RELATED TO DEMOGRAPHICS AND TRANSPORTATION (1970-1999)



4. AIR QUALITY IN COCONINO COUNTY

The air in Coconino County is healthy to breathe, according to monitoring data collected by the Arizona Department of Environmental Quality, the National Park Service, and the Salt River Project. Violations of the national ambient air quality standards do not occur in the County. However, on some days regional haze causes perceptible reductions in visibility. This chapter describes the air quality, meteorology, and sources of emissions in Coconino County.

MONITORING DATA

In 2000, there were nine air quality monitors operating in Coconino County: two in Flagstaff, two at the Grand Canyon, two in Sycamore Canyon, and one each at Page, Sedona, and the Tusayan airport. Table 4-1 identifies the location of each monitor, the operator, and the pollutants measured. Sampling ended in 2000 at the monitor located at Tusayan Airport.

Carbon monoxide is not monitored in Coconino County, because the concentrations are known to be far below the standard. Carbon monoxide levels have declined significantly in all parts of Arizona as a result of catalytic converters and electronic ignition systems in new vehicles. In the late 1980s, the Phoenix metropolitan area typically experienced more than 100 exceedances of the CO standards each year. Since 1996, there has not been a single violation of the CO standard at any of the 15 monitors in Maricopa County. The two monitoring sites in Pinal County (Apache Junction and the Casa Grande Airport) recorded maximum eight-hour averages of only 10 percent of the standard in 2000.

Lead is monitored in Coconino County, but lead concentrations have fallen dramatically over the last twenty-five years, as a result of the phase-out of leaded gasoline and the implementation of stationary source fuel combustion controls. In general, lead concentrations are a small fraction of the federal standards at all 16 monitors operating in Arizona.

Table 4-2 summarizes recent air quality data collected at monitors in Coconino County. In general, the short-term trends are relatively flat, with no monitor recording a violation of the national ambient air quality standards. Ozone is the only pollutant that approaches the standard on hot summer days. In 1998-2000, the highest eight-hour ozone readings at the South Rim of the Grand Canyon were about 90 percent of the standard. During this same period, peak concentrations in Page were 80 percent of the standard.

As Table 4-2 indicates, other pollutants measured in Coconino County are well below the applicable standards. Nitrogen dioxide at the Page Navajo Generating Station is less than 4 percent of the standard. Particulates in the County are one-third of the annual standard or less, while 24-hour concentrations are even lower. The sulfur dioxide levels measured at Page are negligible.

The only pollutant currently measured in Flagstaff is particulate matter. The Middle School monitor collects particle samples that are smaller than 10 microns and smaller than 2.5

microns. The ADOT monitor measures PM_{10} only. During the mid-1980's, annual concentrations of PM_{10} in Flagstaff averaged nearly 40 ug/m3, or almost 80 percent of the standard. In recent years, annual PM_{10} levels have averaged only 15 ug/m3, representing more than a 60 percent decline since 1985. This reduction can be attributed to the paving of dirt roads, cleaner burning woodstoves and fireplaces, and smoke management programs. Figure 4-1 illustrates the downward trend in annual PM_{10} concentrations in Flagstaff and other locations in Arizona between 1985 and 2000. The PM_{10} data for the Grand Canyon represents the average levels on the 20 percent worst visibility days as measured by the IMPROVE monitors in 1990 through 1999. PM_{10} levels at the Grand Canyon have not exhibited the same downward trend as other locations in Arizona.

The 1999 visibility data for the Grand Canyon and Sycamore Canyon in Table 4-2(F) indicates that light extinction is much higher on the 20 percent worst visibility days. On the Colorado Plateau, most of these hazy days occur during the summer. On the worst days, light scattering attributable to gases in the air (Rayleigh) represents about 10 Mm^{-1} or more than one-third of the total light extinction. Most of the remaining degradation in visibility is caused by anthropogenic sources of fine particulate emissions ($PM_{2.5}$).

Figure 4-2 illustrates the trends in visibility at the Grand Canyon between 1990 and 1999. A change of one deciview is perceptible to the human eye. Unfortunately, visibility on the haziest or clearest days has not improved perceptibly over the ten-year period.

Since $PM_{2.5}$ is a major contributor to visibility impairment, it is instructive to review the trends in annual $PM_{2.5}$ concentrations in Flagstaff and other parts of Arizona. Table 4-3 indicates that abnormally high $PM_{2.5}$ concentrations were experienced in Flagstaff in 1996. This can be explained by the unusually low precipitation and high wind speeds that occurred during that year, as shown in Table 4-4. With the exception of 1996, the $PM_{2.5}$ levels measured in Flagstaff are roughly comparable to those at the Grand Canyon and are about half the concentrations in Nogales, Payson and Phoenix.

At the Grand Canyon and Sycamore Canyon, the worst visibility days generally occur during the warmer months. Table 4-5 shows trends in the seasonal variation in $PM_{2.5}$ and PM_{10} measurements at the Grand Canyon. Note that the highest $PM_{2.5}$ concentrations routinely occur in the spring and summer. With the exception of the fall of 1998, PM_{10} readings are also higher in the spring and summer. Particulate concentrations are highly correlated with regional haze, both on a seasonal and overall magnitude basis.

METEOROLOGY

Meteorology plays an important role in the formation, transport, and dispersion of air pollution. Table 4-4 summarizes the monthly precipitation, minimum and maximum temperatures, and average wind speeds for 1993-2000, as recorded at the Flagstaff airport.

In general, the driest years will produce the highest annual PM-10 concentrations. Dry years with especially windy days can also lead to higher 24-hour PM-10 concentrations. Cold winters can result in higher PM-2.5 due to increased use of fireplaces and wood stoves. The

photochemical reaction that produces ground-level ozone occurs at ambient temperatures over 90 degrees Fahrenheit; so hotter summers typically produce higher ozone readings.

Relative humidity also plays an important role in the formation of sulfates and nitrates that contribute to regional haze. Higher humidity increases the size of sulfate and nitrate particles, which in turn, increases their ability to scatter light. (Light scattering and absorption are the two phenomena that cause the extinction of light by regional haze.) Higher humidity is one reason that regional haze is worse in the Eastern U. S. than the West.

The prevailing wind direction at the Flagstaff airport throughout the year is from the South/Southwest. This means that pollutants transported from Phoenix, Yuma, and Southern California may contribute to regional haze hanging over the Colorado Plateau and Coconino County.

EMISSIONS

In order to quantify the impact of man-made sources of visibility-impairing air pollution on the Colorado Plateau, the Grand Canyon Visibility Transport Commission (GCVTC) created emissions inventories and conducted visibility modeling. Table 4-6 shows the 1990 microscale emissions data for Coconino County developed by Radian Corporation for the GCVTC. As Table 4-6 indicates, with the exception of coarser particulates, Flagstaff is a primary source of emissions in Coconino County.

Table 4-5 contains 1993 microscale emissions for the Grand Canyon. This data was derived from a Radian study documented in a paper by Carl Bowman and others presented to the Air and Waste Management Association in June 1995. The paper concludes that non-road, aircraft and recreational boating are the predominant emission sources in the Grand Canyon, but the Park does not add appreciably to Coconino County emissions (as confirmed in Table 4-5). As part of the inventory, Radian tabulated wildfire emissions for 1986-1992 and prescribed burning emissions for 1989-1993. In the peak fire year of 1989, emissions from wildfires exceeded the Park's microscale inventory of anthropogenic emissions by a factor of two. In addition, maximum elemental and organic carbons emitted by prescribed fires during the period 1986 through 1992 were about half of the emissions from other human sources in the Park. This data reveals that wildfires and prescribed fires can contribute a significant portion of the emissions causing visibility impairment, especially in years when conditions are most conducive to burns. Thus, smoke management programs are one important element in the effort to reduce visibility impairment in Class I areas.

The Western Regional Air Partnership has recently developed emissions data by county for pollutants contributing to regional haze in the western U.S. These data are being used to model current and projected visibility impairment in Class I areas, including the Grand Canyon. The latest mobile source emissions for Coconino County, derived from the WRAP inventories, are shown in Table 4-7.

The sources of the emissions in Table 4-7 are on-road and non-road gasoline and diesel-fueled vehicles and engines. The on-road component of the inventory includes exhaust, evaporative, tire-wear, and brake-wear, but not dust re-entrained by vehicles traveling on paved roads. The off-road component of the inventory includes emissions from airplanes, locomotives, watercraft and construction equipment. Western Regional Air Partnership consultants used the latest EPA models (i.e. MOBILE6, NONROAD) in preparing the mobile source emission inventories. The demographic and travel-related assumptions used in developing Coconino County emissions were derived from the EPA National Emissions Inventory and the Federal Highway Administration's Highway Performance Monitoring System.

As Table 4-7 indicates, total mobile source emissions in Coconino County are expected to decline by more than 40 percent by 2018. This reduction is due primarily to Tier 2 light-duty standards, beginning with the 2004 model year, stricter heavy-duty vehicle and engine controls, beginning with the 2007 model year, and low-sulfur gasoline and diesel fuels, beginning in mid-2006. The magnitude of the decline in mobile source emissions is even more impressive when you consider that the WRAP assumed vehicle-miles of travel in Coconino County would grow by 70 percent between 1996 and 2018.

VISIBILITY MODELING

In mid-2002, WRAP consultants conducted modeling to determine the impact of the Federal Tier 2 and heavy duty vehicle and fuel controls, and other measures implemented since 1996, on visibility in the Grand Canyon, Sycamore Canyon and other Class I parks and wilderness areas. Table 4-8 shows the modeling results in terms of light extinction for the 20% worst visibility days in the 16 Class I areas on the Colorado Plateau. Note that visibility on the worst days is expected to improve slightly at the Grand Canyon, but deteriorate at Sycamore Canyon. A change of one deciview (DV) would be visible to the naked eye.

SUMMARY

The impact which Coconino County emissions may have on present and future visibility at the Grand Canyon and Sycamore Canyon has not been explicitly modeled by the WRAP. However, some portion of the anthropogenic emissions contributing to regional haze at these sites is produced locally.

One-third to one-half of the haze on the worst days is attributable to natural light particle (Rayleigh) scattering. Figure 4-3 indicates that sulfates represent 43% of the human-caused visibility problems in the Grand Canyon. Sulfates are produced primarily by power plants and industrial boilers. Crustal material from paved and unpaved roads and construction activities contribute another 24%. The sources of these emissions are likely to be very close to the Grand Canyon, because coarse particles are relatively heavy and tend to deposit within a small radius of their source. The remaining pieces of the pie - organic carbon, elemental carbon, and the non-industrial portion of the nitrates - are emitted primarily by automobile

and truck exhaust and combustion sources. In a worst case scenario, these sources in Coconino County would contribute about 20% of the regional haze at the Grand Canyon on a bad visibility day.

WRAP modeling for 2018 indicates that all mobile sources (on-road and non-road) in the nine-state GCVTC region (Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming) will contribute 14 percent of the regional haze in the Grand Canyon and Sycamore Canyon. In the Grand Canyon, two-thirds of the 14% percent (or 9% percent) is contributed by mobiles sources in California, with another one percent coming from mobile sources in Phoenix and one percent, from Las Vegas. In Sycamore Canyon, 7% percent of the haze in 2018 is expected to come from mobile sources in California, with another 2 percent contributed by Phoenix. This means that, in 2018, mobile sources outside of California, Phoenix and Las Vegas (including Coconino County) will contribute no more than 3% percent of the regional haze in the Grand Canyon and 5 percent in Sycamore Canyon.

While the prevailing wind direction (SSW) minimizes the transport of emissions from Flagstaff to the Grand Canyon and Sycamore Canyon, other downwind Class I areas (i.e. Mesa Verde, Canyonlands, Arches, Weminuche) may experience visibility impairment as a result of emissions from Coconino County. In addition, the source attribution pie chart in Figure 4-3 and the modeling performed by the WRAP represent average meteorological and emission conditions. On any given day, if the wind were blowing from the Northeast or Southeast, Coconino County would contribute a greater portion of the visibility degradation at the Grand Canyon, Sycamore Canyon, and/or other downwind areas.

In summary, the major pollutants of concern for Coconino County are ozone, $PM_{2.5}$ and PM_{10}. Ozone is a potential problem because recent readings at the Grand Canyon show eight-hour ozone levels to be within 90 percent of the National Ambient Air Quality Standard. $PM_{2.5}$ levels need to be controlled in order to reduce their contribution to formation of regional haze. PM_{10} also contributes to regional haze, although the coarser fraction ($>PM_{2.5}$) does not travel as far as the smaller fraction. To be most effective in reducing visibility impairment at the Grand Canyon and Sycamore Canyon, Coconino County efforts to reduce PM_{10} should focus on areas close to these Class I areas.

TABLE 4-1. AIR QUALITY MONITORS IN COCONINO COUNTY

Monitor	Location	Operator	Pollutant
Flagstaff, ADOT	5701 E. Railroad Ave	ADEQ	PM_{10}
Flagstaff, Middle School	755 N. Bonito	ADEQ	PM_{10}, $PM_{2.5}$
Grand Canyon, Hance Camp	S. Rim, 2.5 mi W. of Village	NPS	O_3, Pb, Visibility
Grand Canyon, Indian Gardens	4.5 mi from Bright Angel T.H.	NPS	Visibility, Pb
Page, Navajo Generating Station	3 mi E. of Page	SRP	O_3, NO_2, PM_{10}, $PM_{2.5}$, SO_2
Sedona	Post Office	ADEQ	PM_{10}
Sycamore Canyon	Camp Raymond	ADEQ	Light Scattering (PM)
Sycamore Canyon	Camp Raymond	NPS	Visibility
Tusayan	Airport	ADEQ	PM_{10}, $PM_{2.5}$

TABLE 4-2(A). NITROGEN DIOXIDE DATA FOR COCONINO COUNTY

Nitrogen Dioxide (NO_2)	2000 Annual Average (ppm)	2000 3-Hr Average (ppm)	2000 24-Hr Average (ppm)
Page, NGS	.002	.041	.014
Standard	.053		

TABLE 4-2(B). OZONE DATA FOR COCONINO COUNTY

	Fourth Highest Eight-Hour Average (ppm)			
Ozone (O_3)	1998	1999	2000	3-Yr Avg
Grand Canyon, S. Rim	.073	.077	.071	.073
Page, NGS	.065	.065	.063	.064
	Standard =.08 ppm			

TABLE 4-2(C). $PM_{2.5}$ DATA FOR COCONINO COUNTY

	Annual Average (ug/m^3)				24-Hour - 98th Percentile (ug/m^3)			
$PM_{2.5}$	1998	1999	2000	3-yr Avg	1998	1999	2000	3-yr Avg
Flagstaff, M.S.	4.7	4.9	4.7	4.8	8.1	9.7	12.4	10
	Standard = 15 ug/m^3				Standard = 65 ug/m^3			

TABLE 4-2(D). PM_{10} DATA FOR COCONINO COUNTY

PM_{10}	Annual Average ($\mu g/m^3$)				Annual Average ($\mu g/m^3$)		
	1998	1999	2000	3-yr Avg	1998	1999	2000
Flagstaff, ADOT	12.1	18.0#	15.3	15	33	62#	38
Flagstaff, M.S.	12.6	14.0	15.5	14	30	35	39
Page			10.8			20	26
Sedona	10.4		11.5		54	17	24
Tusayan						14	
	Standard = 50 $\mu g/m^3$				Standard = 150 $\mu g/m^3$		

TABLE 4-2(E). SULFUR DIOXIDE DATA FOR COCONINO COUNTY

Sulfur Dioxide (SO_2)	2000 Annual Average ($\mu g/m^3$)	20003-Hr Average ($\mu g/m^3$)	200024-Hr Average ($\mu g/m^3$)
Page, NGS	<1	14	7
Standards	80	1300	365

TABLE 4-2(F). 1999 VISIBILITY DATA FOR COCONINO COUNTY

Visibility (Light Extinction)	Dirtiest 20% Of Days (Mm^{-1})	Annual Mean (Mm^{-1})	Cleanest 20% Of Days (Mm^{-1})
Grand Canyon	23	16	7
Sycamore Canyon	27	13	4

#Less than 75% data recovery in one or more quarters

TABLE 4-3. ANNUAL $PM_{2.5}$ TRENDS IN ARIZONA ($\mu g/m^3$) (Standard = 15 $\mu g/m^3$)

	Flagstaff	Nogales	Payson	Phoenix[1]	Grand Canyon[2]
1991		12.3	17.9		4.1
1992		12.6	17.2		NA
1993	5.4	9.7	13.0		4.5
1994	4.9	10.4	15.8		4.7
1995	5.8	14.3	15.7	12.6	4.0
1996	11.2	13.3	14.4	13.4	4.4
1997	5.0	11.3	12.2	12.1	3.6
1998	4.7	12.5	10.9	10.9	4.9
1999	4.9	16.0#	9.8	10.8	4.6
2000	4.8	12.8	10.0	10.4	NA

[1]Downtown Supersite

[2]Reconstructed fine mass from IMPROVE monitoring for average of 20% worst visibility days

#Less than 75% data recovery in one or more quarters

TABLE 4-4. METEOROLOGY DATA FOR FLAGSTAFF AIRPORT

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Wind Speed (mph)													
1993	4.8	5.7	4.4	4.4	3.8	4.3	4.0	2.7	2.7	3.0	3.2	3.4	3.9
1994	2.9	3.6	3.4	3.7	3.9	6.1	5.8	4.3	4.6	4.9	7.9	5.4	4.7
1995	5.7	6.3	7.5	8.1	8.6	7.5	5.5	4.2	5.2	5.8	5.5	5.5	6.3
1996	7.6	7.4	7.9	8.3	9.5	7.2	5.2	5.3	5.4	6.3	6.0	7.5	7.0
1997	7.5	6.4	6.4	7.6	5.8	7.4	5.8	4.1	5.0	6.6	4.8	6.8	6.2
1998	4.8	6.4	7.1	7.4	8.1	8.5	5.3	4.1	4.9	5.9	5.5	7.4	6.3
1999	5.9	6.6	7.3	9.0	8.3	7.1	4.9	4.0	4.4	4.7	3.9	7.2	6.1
2000	5.6	7.4	6.0	7.4	8.4	7.0	6.0	4.2	6.1	5.5	5.9	5.4	6.2
Precipitation (inches)													
1993	9.3	11.2	0	0	0	0	0	3.1	3	3.1	3	0	32.7
1994	0	2.8	3.1	3	0	N/A	3.1	3.1	3	0	3	N/A	N/A
1995	N/A	N/A	N/A	0	N/A	0	0	N/A	N/A	0	0	N/A	N/A
1996	0	0	0	0	0	0	3.1	0	3	0	0	0	6.1
1997	3.1	0	0	0	0	0	0	3.1	3	0	0	3.1	12.3
1998	0	2.8	3.1	3	0	0	6.2	3.1	3	3.1	3	0	27.3
1999	0	0	0	3	0	0	3.1	3.1	6	0	0	0	15.2
2000	0	2.9	3.1	0	0	0	0	3.1	0	3.1	0	0	12.2
Minimum Temperature (degrees Fahrenheit)													
1993	22.2	22.9	25.4	29.7	36.2	41.6	48.5	49.9	39.5	31.7	20.9	16.0	32.0
1994	17.9	15.9	26.6	29.3	35.4	N/A	48.2	51.9	42.3	27.8	20.1	20.8	N/A
1995	18.8	24.2	25.9	26.7	32.7	36.5	46.3	52.2	42.7	28.6	25.3	17.1	31.4
1996	16.4	24.1	22.6	27.3	36.4	42.4	54.0	49.8	41.3	29.5	23.0	21.0	32.3
1997	17.5	17.3	22.3	27.1	36.2	39.0	45.5	49.9	46.0	29.6	23.4	15.3	30.8
1998	19.2	17.3	20.6	24.2	31.5	36.5	50.5	50.4	43.9	29.6	22.3	19.0	30.4
1999	18.4	19.6	23.3	24.7	32.5	40.5	51.8	48.0	40.8	27.5	20.1	14.2	30.1
2000	18.7	22.9	22.5	28.7	37.0	44.5	49.1	50.9	42.9	32.6	17.9	20.5	32.4

TABLE 4-4. METEOROLOGY DATA FOR FLAGSTAFF AIRPORT (continued)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Maximum Temperature (degrees Fahrenheit)													
1993	42.3	42.1	54.9	63.1	71.5	79.1	82.5	79.7	76.3	63.1	49.1	44.2	62.3
1994	47.7	44.0	54.5	59.3	67.9	N/A	82.5	80.7	73.8	60.5	44.3	43.3	N/A
1995	38.3	50.2	50.5	54.2	59.8	73.6	82.7	81.5	75.3	66.7	59.3	46.2	61.5
1996	46.4	50.2	53.0	62.4	73.7	81.6	82.8	81.2	68.9	59.9	47.0	45.9	62.8
1997	39.2	41.8	56.5	53.9	72.0	75.1	82.0	77.6	72.8	60.4	51.9	38.7	60.2
1998	43.7	37.4	46.7	50.1	62.0	73.5	81.9	79.5	70.6	59.5	51.8	43.7	58.4
1999	49.3	50.6	54.7	50.3	66.2	75.4	76.5	76.2	71.4	67.8	60.8	44.2	62.0
2000	47.1	48.3	48.2	64.4	73.8	79.8	83.6	79.0	77.3	59.7	43.8	48.8	62.8
Relative Humidity (Percent) at 10:00 a.m., MST													
[1]	53.0	51.0	45.0	35.0	29.0	23.0	34.0	40.0	37.0	38.0	45.0	51.0	40.0

[1]Averaged Over 39 Years
Source: Western Regional Climate Center

TABLE 4-5. SEASONAL VARIATIONS IN AVERAGE PARTICULATE CONCENTRATIONS AT THE GRAND CANYON

	1997	1998	1999	2000	2001	2002
			$PM_{2.5}$			
Fall	2.9	3.0	3.2	1.6	2.1	
Winter		1.7	2.1	1.8	1.3	1.2
Spring		4.0	5.4	4.0	3.5#	3.7#
Summer		4.2	4.3	3.8	3.3	
Annual Avg.		3.2	3.8	2.8	2.6	
			PM_{10}			
Fall	6.9	12.5	6.8	3.0	3.7	
Winter		6.9	10.5	4.5	2.2	2.0
Spring		10.9	16.6	9.9	7.8	8.8#
Summer		11.8#	11.0	7.8	5.4	
Annual Avg.		10.5	11.2	6.3	4.8	

Source: IMPROVE Network Data from Colorado State University for GRCA2
Less than 75% data capture

TABLE 4-6. MICROSCALE EMISSIONS FOR COCONINO COUNTY, FLAGSTAFF, AND THE GRAND CANYON (TONS/YEAR)

Total Emissions	**VOC**	**NOx**	**CO**	**TSP***	**$PM_{2.5}$**	**$EC_{2.5}$**	**$OC_{2.5}$**	**SO_2**
1990 Coconino County	8,547	8,896	51,492	236,893	27,989	461	1,013	743
1990 Flagstaff	5,047	5,176	29,929	54,536	14,265	270	564	428
1993 Grand Canyon	1,200	420		2,000				59
Share of Coconino County Emissions								
Flagstaff	59.0%	58.2%	58.1%	23.0%	51.0%	58.6%	55.7%	57.6%
Grand Canyon	14.0%	4.7%		0.8%				7.9%

Source for 1990 Coconino County and Flagstaff data: Ryan and Kendall, "Final Reconciliation of Transfer Coefficients for Use in the Integrated Assessment System," February 27, 1996.

Source for 1993 Grand Canyon data: Balentine, Dickson, Oliver, Bowman and Rhodes, "Development of a Micro Inventory for Visibility Impact Assessment at Grand Canyon National Park," Presented to the Air and Waster Management Association, June 1995.

*Includes both coarse (between 2.5 and 10 microns) and fine (less than 2.5 microns) particles
Note: All emissions in this table are microscale inventories prepared for the Grand Canyon Visibility Transport Commission by Radian Corporation.

TABLE 4-7. 1996-2018 COCONINO COUNTY MOBILE SOURCE EMISSIONS (TONS/DAY)

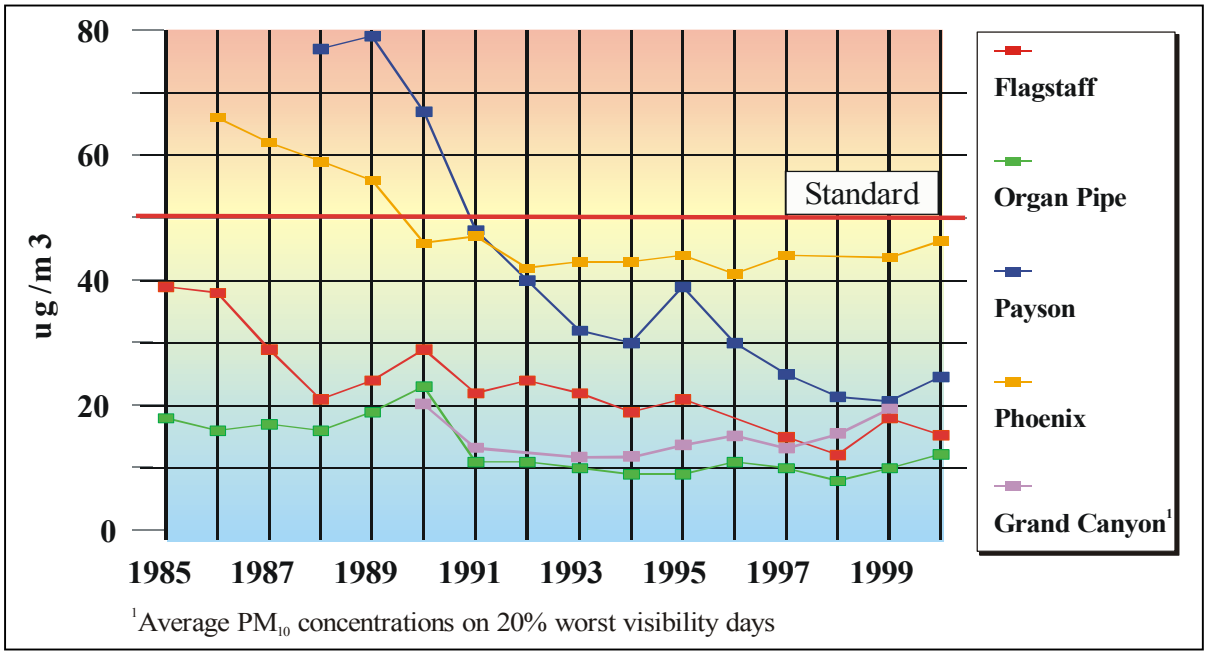
YEAR	VOC	NOx	CO	PM_{10}*	$PM_{2.5}$	SO_2	TOTAL
1996	17.00	19.16	227.86	0.12	1.16	1.12	266.42
1997	16.53	18.81	222.67	0.12	1.14	1.13	260.40
1998	16.05	18.47	217.49	0.11	1.12	1.14	254.38
1999	15.58	18.12	212.30	0.11	1.10	1.16	248.37
2000	15.11	17.78	207.12	0.12	1.07	1.17	242.37
2001	14.63	17.43	201.93	0.12	1.05	1.18	236.34
2002	14.16	17.09	196.75	0.12	1.03	1.20	230.35
2003	13.69	16.74	191.56	0.12	1.00	1.21	224.32
2004	12.88	16.06	183.25	0.12	1.00	1.18	214.49
2005	12.08	15.37	174.93	0.12	0.99	1.15	204.64
2006	11.28	14.68	166.62	0.13	0.98	1.12	194.81
2007	10.47	13.99	158.30	0.13	0.97	1.09	184.95
2008	9.67	13.31	149.99	0.13	0.97	1.07	175.14
2009	9.30	12.75	147.19	0.13	0.94	1.08	171.39
2010	8.92	12.20	144.39	0.13	0.92	1.10	167.66
2011	8.55	11.65	141.59	0.13	0.90	1.12	163.94
2012	8.18	11.09	138.79	0.14	0.87	1.14	160.21
2013	7.81	10.54	135.99	0.14	0.85	1.16	156.49
2014	7.62	10.14	135.44	0.14	0.84	1.17	155.35
2015	7.43	9.74	134.89	0.14	0.84	1.19	154.23
2016	7.24	9.34	134.34	0.15	0.83	1.21	153.11
2017	7.05	8.94	133.79	0.15	0.82	1.23	151.98
2018	6.87	8.54	133.24	0.15	0.82	1.24	150.86
2018 vs 1996	-59.59%	-55.43%	-41.53%	25.00%	-29.31%	10.71%	-43.38%

*Coarse fraction only (particles between 2.5 and 10 microns)

TABLE 4-8. PROJECTION OF VISIBILITY CHANGES - WORST 20 PERCENT DAYS

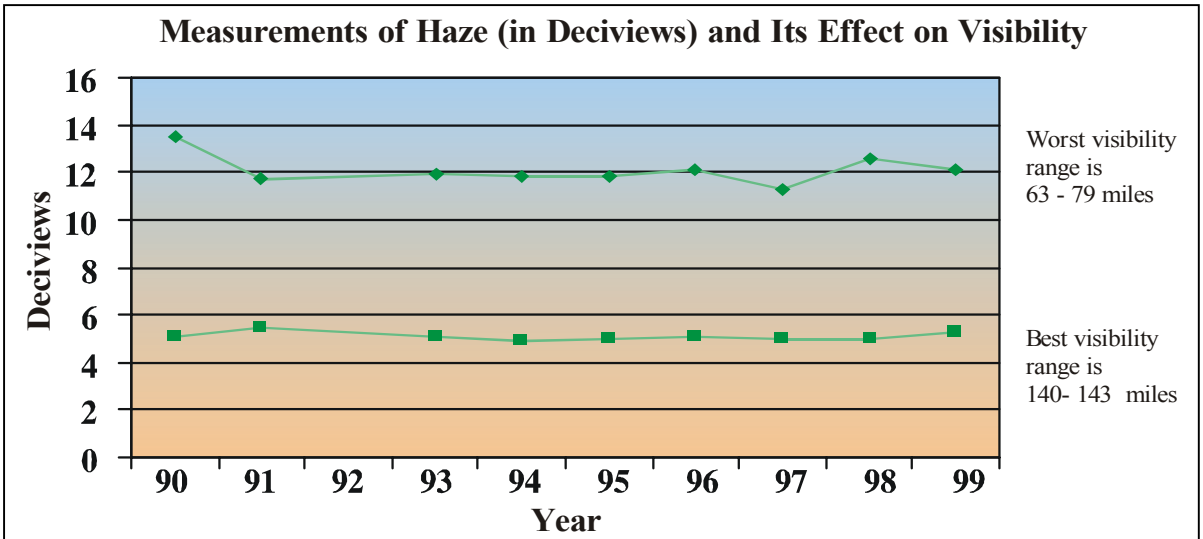
Worst 20% Days 16 Class I Areas Colorado Plateau	Scaled (RRF) 1996 Observed (dv)	Scaled (RRF) 2018 Scaled Base (dv)	Difference (Δdv)
Arches NP	12.94	12.96	0.01
Black Canyon Gunnison NP	11.65	11.84	0.20
Bryce Canyon NP	12.96	12.24	-0.73
Canyonlands NP	12.83	12.29	-0.53
Capitol Reef NP	13.00	12.81	-0.19
Flat Tops Wilderness	11.63	11.23	-0.40
Grand Canyon NP	12.23	11.79	-0.44
Maroon Bells-Snowmass WA	11.87	11.33	-0.54
Mesa Verde NP	12.37	12.06	-0.31
Mount Baldy Wilderness	12.70	13.84	1.14
Petrified Forest NP	12.65	11.99	-0.66
San Pedro Parks Wilderness	12.72	11.37	-1.34
Sycamore Canyon Wilderness	12.64	13.45	0.81
West Elk Wilderness	11.75	11.15	-0.60
Weminuche Wilderness	11.54	10.89	-0.65
Zion NP	12.89	12.69	-0.20

FIGURE 4-1. ANNUAL PM_{10} TRENDS IN ARIZONA



[1]Average PM_{10} concentrations on 20% worst visibility days

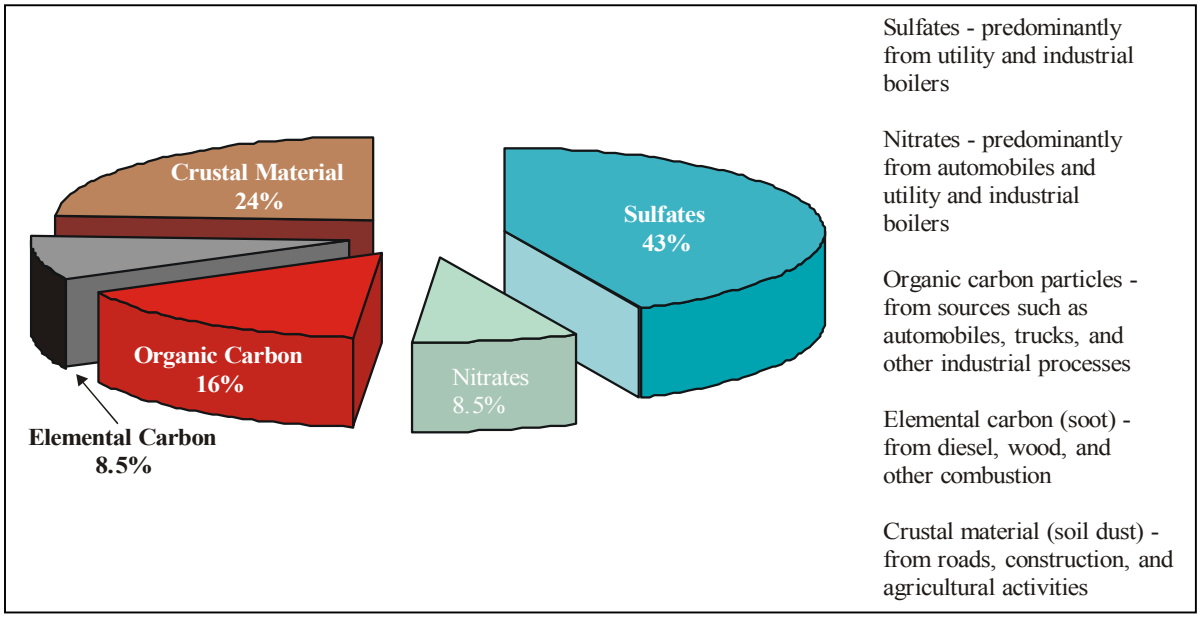
FIGURE 4-2. TRENDS IN VISIBILITY AT GRAND CANYON NATIONAL PARK



A deciview is a measurement of haze that gauges the impact air pollutants have on visibility. Zero deciviews is an indicator of clear conditions with no visibility impairment. The more deciviews measured, the more visibility impairment that limits the distance that can be seen. Worst and best visibility lines represent averages of the 20% worst and best visibility days, respectively, during a given year.

Source: IMPROVE monitoring data from Colorado State University for the GRCA site

FIGURE 4-3. POLLUTANTS THAT CONTRIBUTED TO REDUCED VISIBILITY ON THE WORST DAYS IN 1997 AT GRAND CANYON NATIONAL PARK



Source: Environmental Protection Agency

5. AIR QUALITY IMPROVEMENT STRATEGIES

Forty-seven air quality improvement strategies were identified for potential implementation as part of an air quality sustainability plan for the Central Yavapai County area. Detailed descriptions of these strategies and their applications elsewhere are provided in Appendix A of the final report for the Central Yavapai County Study. Regulatory strategies that require Federal or State legislative action—i.e. inspection maintenance, oxygenated fuels, vapor recovery—have not been included. Some of the strategies are only effective in reducing particulates. Others achieve reductions in more than one pollutant.

The cost component of the cost-effectiveness measure included estimates of direct consumer costs, as well as administrative costs, in 1998 dollars. The effectiveness component of the measure was based on the annual emissions reduced in tons per year. The resultant cost-effectiveness measures were compared with California Air Resource Board (CARB) guidelines to rate each air quality improvement strategy as good, fair, or poor.

The highest cost-effectiveness levels for recently-adopted CARB measures (converted from 1990 to 1998 dollars) were $27,500 per ton of VOC reduced, $2,500 per ton of CO reduced, and $12,500 per ton of PM_{10} reduced. It was assumed that cost-effectiveness was "good", if less than 20 percent of the CARB rates; fair, if plus or minus 20 percent; and poor, if greater than 20 percent.

A summary of the forty-seven strategies, the pollutants reduced, the most likely implementation mechanism, and a cost-effectiveness rating is provided below. While many of these strategies may not be appropriate for implementation in Coconino County (i.e. agriculture), all sources are addressed here for completeness. This compendium can be used as a guide to the types of strategies that might be considered for local implementation. More detailed descriptions of strategies appropriate for Coconino County will be developed after discussion with stakeholders participating in local visioning sessions.

AIR QUALITY IMPROVEMENT STRATEGIES

Source Category 1: Fugitive Dust

1.1 Fugitive Dust Control Plans - Construction and earth-moving operators would develop a plan and apply control measures to minimize dust at the project site; the plan would have to be approved before a grading and drainage permit were issued.

- Pollutants Reduced – **PM-10, PM-2.5**
- Implementation Mechanism – **Ordinance**
- Cost-Effectiveness – **Good** for large-scale projects; **Poor** for small-scale projects

1.2 Control Bulk Material Transport Emissions – Requires trucks to be covered, minimum freeboard maintained or transport material to be treated to prevent its escape; also prescribes remedies for clean-up if accidental spillage occurs.

- Pollutants Reduced – **PM-10, PM-2.5**
- Implementation Mechanism – **Ordinance**
- Cost-Effectiveness – **Good**

1.3 Cleaning of Industrial Paved Roads – Requires owners/operators to conduct frequent, routine cleaning of roads leading to construction or industrial sites, ideally with vacuum sweepers.

- Pollutants Reduced – **PM-10, PM-2.5**
- Implementation Mechanism – **Ordinance**
- Cost-Effectiveness – **Poor**

1.4 Stabilize Unpaved Haul Roads – Requires owners/operators to stabilize dust from vehicles traveling on unpaved roads, parking or staging areas at commercial, municipal and industrial facilities.

- Pollutants Reduced – **PM-10, PM-2.5**
- Implementation Mechanism – **Ordinance**
- Cost-Effectiveness – **Good**

1.5 Stabilize Material Storage Piles – Requires owners/operators to minimize dust emanating from bulk material storage piles.

- Pollutants Reduced – **PM-10, PM-2.5**
- Implementation Mechanism – **Ordinance**
- Cost-Effectiveness – **Poor**

1.6 Mitigation Bond Requirements – Requires dust control plans (See 1.1) for construction and earth-moving operations to be accompanied by a letter of credit or bond, which guarantees that particulate pollution will be mitigated.

- Pollutants Reduced – **PM-10, PM-2.5**
- Implementation Mechanism – **Ordinance***
- Cost-Effectiveness –**Good**

*Would likely be included in the Dust Control Plan Ordinance (Strategy 1.1)

1.7 Limitations on Opacity – Requires dust-generating operations to comply with a 20 percent opacity limit.

- Pollutants Reduced – **PM-10, PM-2.5**
- Implementation Mechanism – **Ordinance**
- Cost-Effectiveness – **Good**

1.8 Mitigate or Prevent Dust on Vacant Lots – Requires owners/operators to implement control measures on vacant lots disturbed by vehicles or other dust-generating activity.

- Pollutants Reduced – **PM-10, PM-2.5**
- Implementation Mechanism – **Ordinance**
- Cost-Effectiveness – **Poor**

1.9 Control Dust from Weed Abatement Operations – Requires owners/operators to apply dust control measures prior to, during and after weed abatement operations. Encourages mowing, rather than disking or blading of weeds.

- Pollutants Reduced – **PM-10, PM-2.5**
- Implementation Mechanism – **Ordinance**
- Cost-Effectiveness – **Poor**

1.10 Stabilize Dust on Public Property – Municipalities adopt measures (i.e. paving, graveling, stabilizing, mowing weeds, discontinuing use of leaf blowers) to mitigate dust on property that they own.

- Pollutants Reduced – **PM-10, PM-2.5**
- Implementation Mechanism – **Municipal Program**
- Cost-Effectiveness – **Good**

Source Category 2: Unpaved Roads

2.1 Stabilize Unpaved Roads and Alleys – Involves the paving, graveling or stabilizing of unpaved roads and alleys with a significant volume of daily traffic.

- Pollutants Reduced – **PM-10, PM-2.5**
- Implementation Mechanism – **Municipal Program**
- Cost-Effectiveness – **Good**

2.2 Reduce Speeds on Unpaved Roads – Involves the implementation of techniques such as speed bumps or lower speed limits to encourage use of alternative paved routes.

- Pollutants Reduced – **PM-10, PM-2.5**
- Implementation Mechanism – **Municipal Program**
- Cost-Effectiveness – **Good**

2.3 Limit Use of Off-Road Vehicles on Public Property – Involves restricting or controlling the use of off-road vehicles on municipally owned unpaved roads or vacant land.

- Pollutants Reduced – **PM-10, PM-2.5**
- Implementation Mechanism – **Municipal Program**
- Cost-Effectiveness – **Poor**

Source Category 3: Paved Roads

3.1 PM-10 Efficient Street Sweeping – Involves replacing existing broom sweepers, as they are retired, with vacuum units that have been certified as PM-10 efficient.

- Pollutants Reduced – **PM-10, PM-2.5**
- Implementation Mechanism – **Municipal Program**
- Cost-Effectiveness – **Good**

3.2 Rapid Cleanup of Material Deposits on Paved Roads - The property owner or operator responsible for the spill must remove the deposits from the paved surface within a grace period and provide for traffic re-routing.

- Pollutants Reduced – **PM-10, PM-2.5**
- Implementation Mechanism – **Ordinance**
- Cost-Effectiveness – **Good**

3.3 Stabilize Unpaved Shoulders and Access Points – Municipalities pave, gravel, or stabilize unpaved shoulders and access points to paved public roads.

- Pollutants Reduced – **PM-10, PM-2.5**
- Implementation Mechanism – **Municipal Program**
- Cost-Effectiveness – **Fair**

Source Category 4: Wood Burning Controls

4.1 Clean Burning Fireplaces in New Construction – Prohibits the installation or construction of fireplaces and wood stoves in new construction, unless the units are "clean burning," as defined by EPA.

- Pollutants Reduced –**PM-2.5, PM-10, CO, NOx**
- Implementation Mechanism – **Ordinance**
- Cost-Effectiveness – **Fair**

4.2 Retrofit Existing Fireplaces and Wood Stoves – Requires all existing fireplaces and wood stoves to be replaced with "clean burning" units, as defined by EPA.

- Pollutants Reduced –**PM-2.5, PM-10, CO, NOx**

- Implementation Mechanism – **Ordinance**
- Cost-Effectiveness – **Fair**

4.3 Episode Curtailment Program for Wood Smoke – Establishes criteria and procedures for declaring "non-burn" days, based on PM-10, PM-2.5 and/or CO monitoring data. One simple and effective way to communicate the days on which burning is prohibited is to publicize "red" days for no-burning and "green" days when it is OK to burn. This could be done on web sites, as well as part of local meteorological forecasts.

- Pollutants Reduced –**PM-2.5, PM-10, CO, NOx**
- Implementation Mechanism – **Ordinance**
- Cost-Effectiveness – **Poor**

4.4 Public Information Program on Fireplaces and Wood Smoke – Involves keeping the public routinely informed about monitored air pollution concentrations and the relationship between wood combustion and these readings.

- Pollutants Reduced –**PM-2.5, PM-10, CO, NOx**
- Implementation Mechanism – **Municipal Program**
- Cost-Effectiveness – **Poor**

4.5 Firewood Moisture Limits – Bans the sale of wood with high moisture content (i.e. >20 percent).

- Pollutants Reduced –**PM-2.5, PM-10, CO, NOx**
- Implementation Mechanism – **Ordinance**
- Cost-Effectiveness – **Poor**

4.6 Establish an Opacity Program for Residential Wood Smoke – Provides education on proper operation and maintenance of wood burning devices to owners/occupants of homes emitting highly-visible wood combustion emissions.

- Pollutants Reduced - **PM-2.5, PM-10, CO, NOx**
- Implementation Mechanism – **Ordinance**
- Cost-Effectiveness – **Good**

4.7 Provide Alternative Heating Options – Encourage providers to accelerate construction of natural gas lines and extension of propane service to residences and businesses and provide incentives to facilitate conversion to alternative fuels.

- Pollutants Reduced - **PM-2.5, PM-10, CO, NOx**
- Implementation Mechanism – **Voluntary Program**

- Cost-Effectiveness – **Good**

4.8 PM-10 Episode Thresholds – Establish PM-10 thresholds, such as those in other areas impacted by wood smoke, which determine, along with meteorological conditions, when air pollution advisories and "no-burn" days are declared.

- Pollutants Reduced - **PM-2.5, PM-10, CO, NOx**
- Implementation Mechanism – **Ordinance**
- Cost-Effectiveness – **Poor**

4.9 Smoke Management Programs - Strengthen existing smoke management programs to avoid burning on days when environmental conditions are conducive to transport of emissions to populated areas or degradation of visibility at Class I areas. Prohibit activity in forested areas during drought conditions.

- Pollutants Reduced: **$PM_{2.5}$, PM_{10}, CO, NOx**
- Implementation Mechanism - **Municipal Program**
- Cost-Effectiveness - **Good**

Source Category 5: Heavy–Duty Vehicles and Equipment

5.1 Limit Heavy-Duty Vehicle Idling – Local bus and trucking companies would be encouraged to impose limits on idling time and/or utilize auxiliary cooling/heating systems that reduce idling emissions. This could be accomplished through workshops and incentive programs. Alternatively, local governments could pass ordinances limiting idling times.

- Pollutants Reduced – **CO, NOx, PM-10, PM-2.5**
- Implementation Mechanism – **Voluntary Program or Ordinance**
- Cost-Effectiveness –**Good**

5.2 Inventory Diesel Equipment and Upgrade/Replace High Emitters – Businesses and government agencies would be encouraged to inventory and inspect their diesel equipment and target the highest emitters for replacement, repair, or retrofit.

- Pollutants Reduced –**PM-2.5, PM-10, CO, NOx**
- Implementation Mechanism – **Voluntary Program**
- Cost-Effectiveness –**Good**

Source Category 6: Agriculture

6.1 Agricultural Best Management Practices – Local farmers would be encouraged to apply PM-10 control measures identified by the Governor's Agricultural Best Management Practices Committee for application in the Maricopa County PM-10 Nonattainment area.

- Pollutants Reduced – **PM-10, PM-2.5**
- Implementation Mechanism – **Voluntary Program**
- Cost-Effectiveness – **Poor**

6.2 Cattle Feedlots and Livestock Areas – Requires implementation of measures to control dust generated by commercial feedlots and livestock roping areas.

- Pollutants Reduced - **PM-10, PM-2.5**
- Implementation Mechanism – **Ordinance**
- Cost-Effectiveness – **Poor**

Source Category 7: Vehicles

7.1 Encourage Conversion to Alternative Fuels - Information about existing incentives and benefits of converting vehicles to alternative fuels would be disseminated to local government agencies, businesses and individuals. Demonstration programs for selected corridors or zones might also be sponsored.

- Pollutants Reduced - **PM-2.5, PM-10**
- Implementation Mechanism – **Voluntary Program**
- Cost-Effectiveness – **Good**

7.2 Limit Cold Starts and Idling of Engines – An information campaign would encourage local businesses and government agencies to limit their vehicle idling to three minutes, especially in colder weather. Alternatively, local governments could pass ordinances limiting idling times.

- Pollutants Reduced - **PM-2.5, PM-10**
- Implementation Mechanism – **Voluntary Program or Ordinance**
- Cost-Effectiveness – **Poor**

Source Category 8: Transportation Control Measures

8.1 Alternatives to Single Occupant Vehicle Travel – Funding for other modes (i.e. bus system improvements, bicycle and pedestrian facilities, areawide ridesharing, high occupancy vehicle lanes, and park-and-ride lots) would be increased to discourage single occupant vehicle trips.

- Pollutants Reduced – **CO, VOCs, NOx, PM-10, PM-2.5**
- Implementation Mechanism – **Municipal Program**
- Cost-Effectiveness – **Poor**

8.2 Traffic Flow Measures – Funding for traffic flow measures (i.e. traffic signal synchronization, incident management and intersection improvements) would be increased in order to reduce vehicle delay and exhaust emissions.

- Pollutants Reduced – **CO, VOCs, NOx**
- Implementation Mechanism – **Municipal Program**
- Cost-Effectiveness – **Good**

8.3 Market-Based Measures – Financial disincentives, such as parking pricing, buying-back old vehicles, congestion pricing, emissions/VMT-based taxes and fuel taxes, would be imposed to reduce vehicle emissions.

- Pollutants Reduced – **CO, VOCs, NOx, PM-10, PM-2.5**
- Implementation Mechanism – **Municipal Program**
- Cost-Effectiveness – **Poor**

8.4 Employer-Based Measures – Local employers would be encouraged to sponsor programs (i.e. trip reduction, compressed work weeks, telecommuting) to reduce single occupant vehicle trips to work.

- Pollutants Reduced – **CO, VOCs, NOx, PM-10, PM-2.5**
- Implementation Mechanism – **Voluntary Program**
- Cost-Effectiveness – **Poor**

Source Category 9: Land Use and Growth Controls

9.1 Growth Boundaries or Other Growth Limitations – Identify growth boundaries as part of the general plan updates required by the 1998 Arizona Growing Smarter Act.

- Pollutants Reduced – **CO, VOCs, NOx, PM-10, PM-2.5**
- Implementation Mechanism – **Municipal Plan/Zoning**
- Cost-Effectiveness –**Good**

9.2 Innovative Land Use Planning to Encourage Multi-Modal Opportunities – Encouraging transit-oriented development and other innovative land use planning and design techniques (i.e. traffic calming, round-abouts, parking restrictions, auto-free zones) would increase use of alternative modes and discourage use of single occupant vehicles.

- Pollutants Reduced – **CO, VOCs, NOx, PM-10, PM-2.5**
- Implementation Mechanism – **Municipal Plan/Zoning**
- Cost-Effectiveness –**Good**

9.3 Encourage Clean Industries – Municipal policies could be designed to offer special incentives and maximize locational opportunities for "clean air" industries.

- Pollutants Reduced – **CO, VOCs, NOx, PM-10, PM-2.5**
- Implementation Mechanism – **Municipal Policy**
- Cost-Effectiveness –**Good**

Source Category 10: Other Controls

10.1 Restaurant Charbroiler Controls - Requires restaurants with chain-driven charbroilers (i.e. Burger King and Wendy's) to install catalytic converters to reduce particulate emissions.

- Pollutants Reduced – **PM-2.5, PM-10**
- Implementation Mechanism – **Ordinance**
- Cost-Effectiveness – **Good**

10.2 Crack Seal Equipment - Municipalities would procure vacuum units, as older units are retired, to remove dust from cracks during crack seal repair of roadways.

- Pollutants Reduced – **PM-2.5, PM-10**
- Implementation Mechanism – **Municipal Program**
- Cost-Effectiveness –**Good**

10.3 Ban or Restrict Use of Leaf Blowers - Municipalities would not allow gas leaf blowers to be used in landscaping public property.

- Pollutants Reduced – **PM-10, PM-2.5, CO, VOC, NOx**
- Implementation Mechanism – **Municipal Program**
- Cost-Effectiveness – **Good**

10.4 Encourage Use of Electrical Power at Construction Sites - Contractors would be encouraged to use temporary electrical power instead of portable gasoline or diesel generators at construction sites.

- Pollutants Reduced – **PM-10, PM-2.5, CO, VOC, NOx**
- Implementation Mechanism – **Voluntary Program**
- Cost-Effectiveness –**Good**

10.5 Voluntary Business Community Emissions Reductions - Businesses, schools, municipalities and other organizations would be encouraged to participate in a community-wide program to reduce air pollution.

- Pollutants Reduced – **CO, VOC, NOx, PM-10, PM-2.5**
- Implementation Mechanism – **Voluntary Program**
- Cost-Effectiveness – **Poor**

10.6 Encourage Electric Ground Support Equipment at Airports - Tusayan and Flagstaff Airports would be encouraged to use electric rather than diesel or gasoline-fueled equipment to perform airport ground support operations.

- Pollutants Reduced – **CO, VOC, NOx, PM-10, PM-2.5**
- Implementation Mechanism – **Voluntary Program**
- Cost-Effectiveness –**Good**

10.7 Apply "Maximum Allowable Increases" – Establish baselines that are stricter than the National PM-10 standards, based on current monitored concentrations plus 30 ug/m3 for the 24-hour average and plus 17 ug/m3 for the annual average. These baselines could trigger contingency measures and/or declaration of pollution advisories or "no-burn" days.

- Pollutants Reduced –**PM-10, PM-2.5**
- Implementation Mechanism – **Voluntary Program**
- Cost-Effectiveness – **Poor**

10.8 Educational and Outreach Campaign to Sustain Clean Air – Conduct a comprehensive multi-media campaign to promote alternative transportation modes, compressed work schedules, telecommuting, alternative fuels for vehicles, alternatives to wood burning in the winter, and fueling vehicles after 4 p.m. in the summer. Provide the public with pollution advisory information based on the latest monitoring

information available from ADEQ. The educational component could keep construction, demolition, hauling, landscaping and farming operators informed about cost-effective techniques to reduce particulates.

- Pollutants Reduced – **CO, VOCs, NOx, PM-10, PM-2.5**
- Implementation Mechanism – **Voluntary Program**
- Cost-Effectiveness – **Fair**

10.9 Voluntary Lawn Mower Replacement Program – Implement a program to provide incentives for replacing commercial and residential gas lawn mowers/equipment with electric mowers/equipment.

- Pollutants Reduced – **VOC, NOx, CO**
- Implementation Mechanism – **Voluntary Program**
- Cost-Effectiveness – **Good**

10.10 Ozone Awareness Program – Implement a public information program to encourage emission reductions during the peak ozone season, May through September. This would include declaring ozone advisories, based on the EPA Pollution Standards Index and ozone readings at the Page monitor, and encouraging the public to defer use of lawn and garden equipment, refuel vehicles after 4 p.m., reduce vehicle trips, use alternative modes, and telecommute.

- Pollutants Reduced – **VOC, NOx, CO, PM-10, PM-2.5**
- Implementation Mechanism – **Voluntary Program**
- Cost-Effectiveness – **Fair**

10.11 Encourage Alternative Sources of Energy - Implement a public information program and incentives to encourage use of alternatives to petroleum-based energy. Promising alternatives include solar and wind-generated electricity. States participating in Section 309 of the 1999 EPA Regional Haze Regulations (such as Arizona) must try to achieve a goal that renewable energy comprises 10 percent of the regional power needs by 2005 and 20 percent by 2015.

- Pollutants reduced - **$PM_{2.5}$, PM_{10}, CO, NOx**
- Implementation Mechanism - **Municipal**
- Program Cost Effectiveness - **Good**

6. OUTREACH PROGRAMS

This chapter describes representative examples of air quality outreach and education conducted by national, state, and regional air quality organizations throughout America as well as specifically within Arizona. Most of the organizations profiled are those that focus on the air pollutants such as carbon monoxide, ozone, and particulates, and upon the mobile sources of those pollutants, of most interest to Coconino County.

Table 6-1 provides a summary of the programs and sponsoring organizations discussed in this chapter. Table 6-2 summarizes some of the unique programs being conducted by these organizations. Descriptions of the researched programs are ordered alphabetically by organization below.

OUTREACH PROGRAMS IN OTHER STATES

American Lung Association of Gulfcoast Florida

This organization has developed a professional educational program aimed at middle school students. The slogan for the program is "Don't Be An Airhead, Be AirWise." AirWise materials are presented in an easy-to-read and colorful format and address the following: effects of air pollution on health, global warming, outdoor air pollutants, indoor air pollutants, mobile sources of pollution, and pollution prevention and solutions. Each AirWise student packet ($4.25) contains fact sheets, a take-home indoor air checklist, a glossary of terms, and a list of resources. Teachers are provided with a comprehensive instructor's guide ($5) including lesson plans, classroom activities, standardized tests, and classroom aides.

Atlanta Region

The Atlanta metropolitan area is classified as a serious nonattainment area for ozone. The area has been in the spotlight for the past few years because of lawsuits related to air quality conformity determinations. The region has implemented a number of outreach programs to address the ozone problem.

1. Smog Alert Days - To reduce ozone pollution, Atlanta has established a Partnership for a Smog-Free Georgia (PSG). The objectives of the PSG are to educate Georgia citizens about the effects of ground-level ozone and promote voluntary actions that employers, employees, and residents can take to reduce emissions on days when weather conditions are conducive to the formation of ozone. Partnership for a Smog-Free Georgia is an employer-based initiative that encourages participants to reduce their single occupant vehicle rate by at least 20 percent on "Smog Alert Days." Employers are also encouraged to modify or postpone any operations and maintenance activities that might contribute to ozone formation. Written commitments are obtained from public and private organizations. Other outreach activities in the region include: a Clean Air Campaign aimed at educating the public

via the mass media about the ozone problem and actions individuals can take to reduce emissions that lead to ozone; the Atlanta Regional Commission's Commute Connections Program that promotes the use of rideshare matching to facilitate carpooling and vanpooling in the region, and the American Lung Association's annual "Clean Commute Day." Each year PSG quantifies and reports the emission reductions and air quality benefits of the program in the form of a report card. During 1998 there were 35 Smog Alert Days and 22 exceedances of the one-hour ozone standard. The PSG used several methods to measure the effectiveness of its program including a random telephone baseline survey, traffic modeling data, reports from participating employers, intercept surveys at employer work sites. The program increased public awareness of the issue from 37 percent to 55 percent and decreased peak regional traffic volumes by approximately two percent. The PSG is funded with Congestion Mitigation and Air Quality (CMAQ) Improvement funds, state-appropriated funds, and in-kind contributions from the state environmental department. Other information included on the PSG Web site: Air Quality Facts, Take Action, Partners, Just For Kids, Service Providers, Sample Programs, Forms, News, Current Ozone Levels, and Sign up for Smog Alerts. Suggested work site commuter options address promotion of carpooling, shuttles, vanpools, teleworking, transit, bicycling and walking to work. PSG also issues news releases, such as the Governor's proclaiming April 25- May 1 to be "Air Quality Awareness Week," marking the start of the ozone season.

2. Air Quality Monitoring Data - The Georgia Department of Natural Resources Environmental Protection Division maintains a Web site which provides real-time data on ozone concentrations at monitors throughout the state, including metropolitan Atlanta. The 8-hour average ozone readings are updated on an hourly basis. Both actual values and daily plots are provided.

3. The Atlanta Regional Commission (ARC) sponsored a Vision 2020 process involving thousands of citizens in developing a transportation and air quality initiative that states:

   > *The Atlanta Region must work together to clean the air we breathe, decrease pollution and eliminate the Region's air quality nonattainment status. This initiative calls for the creation of a strategic alliance for carrying out the Atlanta Region's "Air Vision" which enhances environmental sustainability and provides continued economic growth.*

   The ARC hosted an Air Quality Summit to provide opportunity for dialogue about public and private sector commitments to achieve healthy air quality in the Atlanta Region. More than 80 representatives from private enterprise, government, civic, and environmental organizations participated in the Summit. Vision 2020 and the Air Quality Summit have acted as a catalyst to encourage development and implementation of new transportation programs. Examples include: advanced traffic management systems, new high occupancy vehicle lanes created through restriping, Commute Connections, Clean Air Campaign, Enhanced I/M Program, Clean Fuel

Fleet, CNG buses, and bicycle and pedestrian projects (using 11 percent of CMAQ funds).

Bakersfield, California

Project Clean Air conducts the Kern Commuter Connection and an innovative Teach the Teachers project.

1. The Commuter Connection is a transportation demand management program providing the following services in Kern County: carpool matching lists, employee workshops, quarterly newsletter, promotional items, and assistance in starting a rideshare program. The program is funded by the California Department of Transportation through the Kern Council of Governments. The Web site provides a rideshare registration form and offers the following tips for carpool success: (www.projectcleanair.ord/programs.htm)

   (a) Give the carpool time to work; it usually takes a few weeks to get going.
   (b) Make it clear that your carpool has a single purpose: commuting to and from work or school. When it starts doubling as a shopping or errand service, friction can result.
   (c) Decide on a regular route and pick-up time for each passenger.
   (d) Agree on a meeting place and time for the trip home.
   (e) Decide how long the carpool will wait for passengers (usually no more than five minutes).
   (f) Is smoking allowed?
   (g) Are snacks and beverages allowed?
   (h) What types of music will be listened to? Make an agreement on the radio station or tapes that everyone can enjoy. If you can't agree, listen to a news station.
   (i) Establish a chain of communications so adjustments can be made with a minimum of inconvenience; for example, early departure due to bad weather.
   (j) Develop an environment that encourages open discussion of carpool-related conflicts or problems.

2. Teach the Teachers is a project to train middle math and science teachers in San Joaquin Valley and Kern County in an air quality curriculum that meets requirements of the California State science framework. The project has received funding from corporate sponsors, local air districts, Project Clean Air members, and local businesses, teachers, and school districts.

California Air Resources Board

The following outreach materials are provided on the CARB web site:

1. Buyer's Guide To Cleaner Cars – Provides advice on low-emission vehicles.
2. 50 Things You Can Do – A pamphlet which identifies strategies for individuals to reduce air pollution
3. Bicycle Awareness Program – Information on the air quality benefits of bicycling.
4. Fact Sheets, Brochures, Presentations – CARB has produced a series of materials addressing air quality issues.
5. Glossary of Air Quality Terms – Defines terms used on the Web site.
6. Library Card Catalog Database – Over 10,000 documents are available in the CARB library.
7. Smoking Vehicle Complaint Hotline – Identifies numbers to call if you see a smoking vehicle.
8. Voluntary Accelerated Vehicle Retirement – This CARB program pays owners to voluntarily retire their older, higher-emitting vehicles.

Denver Region

The Denver metropolitan area has had a long-standing outreach effort to combat winter air pollutants, carbon monoxide, and particulate matter. However, in the summer of 1998 record high ozone levels were measured in the area, which triggered an ozone reduction campaign sponsored by the Regional Air Quality Council and the Colorado Department of Public Health and Environment.

The summer ozone campaign consists of six elements:

1. Implementing an ozone advisory system to warn people in advance of potential high ozone days and ways to change contributing behaviors
2. Obtaining voluntary reductions in the Reid Vapor Pressure (RVP) of gasoline through a partnership with petroleum refiners
3. Reducing gasoline vapor emissions by placing stickers on gas pumps that discourage overfilling ("stop at the click") and offering free gas caps for faulty or missing ones ("put a cap on ozone")
4. Conducting a series of structured meetings with staff of local governments to educate them on ways to reduce ozone
5. Sponsoring a series of media events
6. Using a variety of other outreach tools such as distribution of flyers, appearances on local cable television, and participation in events such as Bike to Work Day and the Boulder Creek Festival.

During the 2000 ozone season the Regional Air Quality Council also conducted an online survey exploring the public's view and practices related to ozone and ozone reduction, (www.take-survey.com/racq/).

1. Ozone Advisory Program – The Air Pollution Control Division (APCD) has devised a system to forecast imminent meteorological conditions that are conducive to formation of ozone concentrations greater than 75 parts per billion (ppb). APCD meteorologists use national and local weather data and a number of national predictive models to make the advisory calls, effective at 4 p.m. each day for the following 24-hour period. The advisories are coordinated with the local media and placed on the APCD web page. The RAQC also provides a fax announcement of the advisories to 33 cities, counties, and local agencies. A hotline has also been established to respond to citizen requests for information. During the summer of 1999 the APCD accurately predicted ozone levels for 98 of the 107 days season (92 percent accuracy). Of the 13 days with ozone levels above 75 ppb, six were correctly identified (46 percent accuracy).

2. Voluntary Reductions in Reid Vapor Pressure – Local air quality agencies worked with the Colorado Petroleum Association and other refiners to reduce the volatility of the gasoline sold in the region during the summer. The objective was to reduce RVP from 9 pounds per square inch (psi) (10 psi for ethanol fuels, which represents 5-10 percent of the market) to 8.5 psi (9.5 for ethanol). The refiners agreed to make the reductions between Memorial Day and Labor Day. This 0.5 psi reduction was expected to achieve a 5-8 percent reduction in mobile source-related emissions. This translates into an approximate 3 percent reduction in total volatile organic compounds (an ozone precursor).

3. Reductions in Evaporative Emissions – One source of volatile organic compounds is spilled and evaporated fuel caused by overfilling of fuel tanks at gas stations. Overfilling can also lead to disabling of vehicle emission control equipment. Local air quality agencies worked with the Colorado-Wyoming Petroleum Marketers Association and major refiners to provide stickers designed to educate the public about the need to "stop at the click." The Association helped to distribute the stickers, which were placed on gasoline pumps. During the summer of 2000 the RAQC sponsored a "Put A Cap on Ozone" campaign whereby motorists with faulty or missing gas caps can receive a free replacement. Funds for the $80,000 program are being provided by the Colorado Department of Transportation and Envirotest Systems Corporation (the vehicle inspection contractor). NAPA Auto Parts has agreed to provide the approximately 12,000 gas caps at a reduced cost.

4. Local Government Outreach – The RAQC staff conducted an ozone workshop for local governments. The agencies were encouraged to bring staff from the Public Works, Parks and Open Space, Facility Management, Fleets, Building Maintenance, Purchasing, and Public Information Departments. The workshop covered sources of ozone for the metro region and strategies to reduce volatile organic compounds caused by local government operations. Participants were asked to report back to the

RAQC regarding strategies that would be implemented. Material provided at the workshops included "stop at the click" stickers, flyers, a sample newsletter article, information on low VOC products, background information on ozone and its sources, large signs to advertise the existence of the flyers, and small reversible signs indicating whether it is a high or low ozone day. Some ozone reduction strategies already being practiced by local governments include regularly scheduled vehicle/equipment tuning and use of water-based paints and non-solvent based cleaning supplies and ink. New strategies most agencies agreed to undertake include fueling after late in the day or after dark, continued education about reducing fuel spillage; avoiding excessive idling and linking trips whenever possible, especially on high ozone days; and making ozone education a part of ongoing citizen education efforts. Strategies which were more difficult for local governments to accomplish, but are being considered over the longer term are: avoiding use of lawn equipment and prioritizing use of engines in low to high order of VOC emissions (i.e. diesel, 4-stroke, 2-stroke) on high ozone days. The replacement of pre-1997 engines and using alternative fueled vehicles are also being considered by local agencies.

5. Media Events – The Denver media campaign had four elements: a media seminar for the press and public information officers, a press conference announcing the voluntary efforts of the petroleum industry to reduce the volatility of gasoline, media announcements during high ozone days, and an end-of-season release describing the results of the high ozone season.

6. Other Outreach Activities – The RAQC staff undertook the following additional activities as part of the ozone public education process: made a presentation to the Boulder County Clean Air Consortium; staffed booths at the Metro Home Builders Association Business to Business Expo, the Boulder Creek Festival, and the American Lung Association's Clean Air Challenge; provided input to newsletters for the City of Boulder staff, the Colorado Association of Commerce, and Industry, and Colorado State University; provided flyers to Envirotest and Bike to Work Day, and taped an interview for Northglenn Cable Access Television.

Smart Signs – Beginning June 1, 2000 the RAQC and Envirotest Systems Corporation (the contractor that performs the vehicle inspection maintenance program) will be sponsoring the use of Smart Signs in locations throughout the Denver metropolitan area. These signs were developed by a Denver University professor to raise public awareness about the importance of a well-maintained car for fuel economy and pollution reduction. Vehicles pass through an invisible beam that instantaneously measures hydrocarbon and carbon monoxide emissions and the Smart Sign flashes a reading of "good," "fair," or "poor."

Las Vegas Region

Educational information on the status of air quality planning in the Las Vegas metropolitan area is contained on a Web site sponsored by Clark County, (www.co.clark.nv.us/compplan/Environ/AQTEAM). The Las Vegas region is a serious

nonattainment area for particulate matter less than ten microns (PM_{10}). The Web site provides the following tips on how citizens can reduce PM_{10}:

1. Keep your vehicle and lawn care equipment properly maintained to ensure optimal performance.
2. Try not to drive on days when the air quality is poor.
3. Drive slowly or limit travel on unpaved roads.
4. Reduce residential wood burning or convert to gas logs.
5. Stabilize disturbed land areas.
6. Report illegal dumping by calling 383-1027.
7. Limit off-road recreational activities to permitted areas.
8. Report smoking vehicles to the DMV by calling 642-SMOG.
9. Plan your errands in advance so that you can reduce the number of trips.
10. Report dust problems or illegal construction activities by calling 383-1276.

The Web site also encourages corporations to:

1. Develop a ride-share program for their employees.
2. Implement a flex-time schedule to reduce traffic congestion during peak travel hours.
3. Acquire alternative fuel vehicles for fleets.
4. Install pollution control devices in production processes.

The Clark County Department of Air Quality Management has conducted a class on Fugitive Dust Control for Construction Activities since September 1997. The course includes a description of particulate pollution, health and quality of life impacts, sources, regulations and plans, specific requirements of Section 94 (the Clark County dust control rule for construction), test methods, sample dust control permits and mitigation plans, and enforcement.

Construction site supervisors, foremen, and other designated on-site representatives of the project developer, as well as the water truck/pull drivers, are required to successfully complete the Dust Control Class. All required personnel must sign up for the Class within seven days of dust control permit issuance and attend within thirty days. Dust Class Certificates/Cards, issued upon successful completion of the course, are valid for three years. Although the course was initially free, $30 is now charged to defray the cost of materials.

Louisiana Department of Environmental Quality

The Louisiana DEQ maintains an educational resource Web site that provides information and links to other Web sites on air quality issues, (www.deq.state/la/us/assistance/educate/index.htm).

Mohave Desert Air Quality Management District

The mission statement of this Southern California air quality agency is "to attain and maintain a healthful environment while supporting strong and sustainable economic growth." The Web site provides a downlink to the EPA Air Pollution Distance Learning Network that offers telecourses on air quality issues, (www.mdaqmd.ca.gov). Training is delivered via satellite and participants can interact with the nation's leading authorities on air pollution control, monitoring devices, and systems. Many of these courses are sponsored by the National Air Pollution Training Institute. Registration is required to receive certificates of training, but the courses may also be audited. Other educational programs available to teachers from the Community Relations and Education Department of the District include: classroom presentations and assemblies at no charge, tours of the air monitoring station, an annual poster contest and Clean Air Fair, educational publications, and a video entitled "Let's Clear the Air…In the Mojave Desert," produced by students from Sultana High School in Hesperia. This video is used as a tool to educate students about the desert's unique air quality issues and the important role individuals play in protecting air quality. The Kid's Page at this Web site contains more information about the annual air quality poster contest including winning entries, the clean air fair, and "recipes" for ozone and smog. In addition to these educational resources, the District's Web site also provides information on air quality data and trends, rules and regulations, special events, and available grants and awards.

State of Oklahoma

The state of Oklahoma, Department of Environmental Quality, maintains a Web site that identifies resources available for environmental education, (www.deq.state.ok.us). Examples of these resources include environmental education grants for K-12 projects and field trips (funded with environmental license plate revenues); multi-media items such as bookmarks, bumper stickers, and posters; and literature and brochures. Members of DEQ's Air Quality Environmental Education Committee will make presentations at schools and environmental fairs that are tailored to the target audience and utilize an interactive approach.

Oklahoma City Region

In December 1996, the Oklahoma City metropolitan area was designated a Flexible Attainment Region (FAR) for carbon monoxide by the EPA. The agreement is in effect for five years. Designation as a FAR for CO avoids an immediate nonattainment designation for Central Oklahoma in the event of a violation of federal standards, allows program participants to create a plan to improve air quality using locally-selected measures appropriate to community needs, and provides time to implement the locally-selected

measures and measure their effectiveness. The Association of Central Oklahoma Governments (ACOG) conducts Clean Air Alert Day and Clean Cities programs. The objective of these programs is to promote private and public sector activities that help "clear the air," while allowing for industrial and population growth. There are three primary motivations for maintaining clean air in the region: public health, avoiding public and private expenses associated with exceeding the standards, and regional economic vitality and growth. Air Quality experts estimate that violating the federal standards could ultimately cost Central Oklahomans $43 million in the transportation sector alone. These expenses would result from having to install special equipment on retail gasoline pumps, using reformulated fuels, and putting tougher vehicle inspections in place, as well as potential restrictions on economic development and highway construction. Reformulated fuels could cost citizens 5-10 cents more per gallon and the cost of inspections could increase by as much as $15.

1. The Clean Air Alert Day Program was established by ACOG in 1992. The program is designed to help citizens and employers take individual responsibility for reducing emissions. Alert days are called when weather conditions are expected to contribute to higher ozone or carbon monoxide levels. A team of meteorologists, environmental professionals, and local government officials monitor weather conditions and notify the media the day before weather conditions are conducive to high pollution. On the following day citizens, businesses, and government employees are encouraged to adjust their travel habits. On Alert Days citizens are urged to ride Metro Transit buses for a reduced fare of 25 cents, carpool, bicycle or stay at home, rather than use a car, and refuel their cars after dark.

2. The Central Oklahoma Clean Cities Program began in September 1995 as a local government-industry partnership of approximately 50 stakeholders. In May 1996, Central Oklahoma became the first region in the United States to meet the Department of Energy requirements necessary to earn a Clean Cities designation. Through an aggressive public awareness campaign, the Clean Cities coalition is continuing to work to educate the public and private sectors regarding the economic and environmental benefits of alternative fuel vehicles.

Oregon Department of Environmental Quality

The Oregon DEQ maintains a Web site that provides general information on air pollutants, what is being done, what you can do, a glossary of terms, resources, and a bibliography, (www.deq.state.or.us/aq/airpollu.htm).

Seattle Region

The Puget Sound Clean Air Agency maintains a Web site that provides information about regional air quality, public education and outreach, business assistance, and air pollution regulations, (www.pscleanair.org). On the education and outreach component of the Web

site, the Puget Sound Clean Air Agency provides a resource manual for teachers, facts on outdoor burning, and information on the "smog watch" summer air quality program and the "burn ban" winter air quality program. The educators' manual, called "Clean Air Express," contains lesson plans and activities for grades K-12. In the Seattle area, outdoor burning is not allowed within the Urban Growth Areas designated by each city, town, and county. "Smog watch" is a voluntary program encouraging individuals to drive less, wait until the temperature falls before using gas-powered lawn and garden equipment, and re-fuel during the cooler evening hours. Major companies like Boeing offer their employees incentives such as free bus passes during smog watches. During a winter "burn ban", no burning is allowed in fireplaces and woodstoves unless they are the only adequate source of heat and all outdoor burning is banned. A University of Washington Study indicates that the burn bans, which have been in effect since 1988, have reduced wood smoke particles by 25-35 percent. Television and radio weather reports are the major sources of public information on smog watches and burn bans in the Seattle area.

Tulsa Region

On August 22, 1995, Tulsa became the first area in the country to be designated as a Flexible Attainment Region. Other areas that have been designated as FARs by EPA since that time include Corpus Christi, Texas, Tyler/Longview, Texas, and Oklahoma City. The FAR designation has allowed Tulsa to exceed the standard (9 times between 1991 and 1997) without being redesignated as an ozone nonattainment area. The FAR approach provides an area with the flexibility to develop ozone reduction strategies tailored to the local economy, meteorological conditions, geography, and transportation behavior. One common element in the FARs is the inclusion of multi-stage controls including voluntary and mandatory measures. The main component of these control packages is an episodic control program. The programs call for other measures of increasing stringency to be implemented in stages, if the NAAQS continue to be violated. In the event of the exceedance of the standards, non-enforceable measures such as smoking vehicle and ozone information hotlines, car care clinics, and employee commute option awareness programs are implemented. In Tulsa, if exceedances continue, additional enforceable measures, such as mandating maximum 8.2 RVP for gasoline and enhancements to the vehicle inspection program, are put into effect. Many of the mandatory measures require a revision to the SIP, while the voluntary measures can be implemented immediately. The Ozone Alert! program and the Tulsa Area Clean Cities program are examples of locally-designed voluntary ozone reduction measures in Tulsa's FAR program.

Flexible Attainment Region – To date, FAR designations have been given to areas that are close to nonattainment. The designation is an incentive for these areas to achieve emission reductions without incurring the economic losses that typically accompany redesignation to nonattainment. The FAR is implemented through a Memorandum of Agreement (MOA) with EPA. If violations of an air quality standard occur after implementation of the MOA, EPA allows additional locally-determined control measures to be included in the SIP and allows time for the measures to work before announcing that the community is not attaining the standards.

1. Ozone Alert! - Tulsa was designated a nonattainment area for ozone in the 1980s and was redesignated an attainment area in November 1990, after three years with no violations. When a violation of the ozone standard occurred again in 1991, the Indian Nation Council of Governments (INCOG) formed an Air Quality Committee, a public/private coalition of local governments, business, industry, health groups, and environmental organizations that developed and implemented the Ozone Alert! program. Ozone Alert! is a set of voluntary efforts implemented by local governments, businesses, industry, and citizens on days when the area is vulnerable to high pollution levels. On Ozone Alert! days the public is urged to limit driving, mowing, and refueling. Nearly 400 businesses in the Tulsa area receive advance notice of Ozone Alert! days through a fax system. Local governments refrain from operating lawn and garden equipment on Ozone Alert! days and, since 1992, local gasoline suppliers have voluntarily distributed fuel producing fewer evaporative emissions during the ozone season, May through September. Tulsa area businesses provide information and offer incentives to encourage their employees to participate in "clean air" activities. Public and school education are other important aspects of the Ozone Alert! program. For example, INCOG sponsors Ozone Alert! poster contests. Research materials, a video describing the Ozone Alert! program, and an EPA ozone video have been placed in faculty libraries throughout the region to encourage teachers to educate their students about air quality issues. Representatives from the INCOG Air Quality Committee Speaker's Bureau are available to speak at local schools, businesses and civic groups about the Ozone Alert! program. The Ozone Alert! Web site also provides real-time eight-hour ozone readings at three monitors in the region, (www.ozonealert.org).

2. Tulsa Area Clean Cities - This is a voluntary program to promote use of cleaner-burning alternatives to gasoline and diesel fuel in motor vehicles patterned on the U.S. Department of Energy's (DOE) Clean Cities program. The goal of DOE's national program is to shift national energy demand away from imported oil and toward renewable or domestically produced sources such as alternative fuels. The focus of Tulsa Area Clean Cities is to bring together key "stakeholders" to coordinate the local expansion of alternative fuel vehicles. These stakeholders include fuel suppliers, vehicle manufacturers, fleet managers, utilities, environmental and health groups, and state and local governments. Through the Clean Cities program, schools, businesses, government agencies, and the public are informed of the environmental and economic benefits of alternative fuels. This information is communicated through workshops, teleconferences and videos. An alternative fuels/air quality curriculum is also being planned to help educate students about alternative fuels.

   An episodic control program such as Ozone Alert! requires an intensive public education and outreach component. Because these programs are typically voluntary, individual behavioral changes are required in order for the programs to be effective. Employers, employees, and the general public need to be cognizant of the problem (i.e. poor air quality) and familiar with a list of activities that help mitigate the problem. Public education benefits can occur in three ways: (1) the public is

educated about air pollutants and their effects, (2) the public becomes aware of the regulatory agencies role in improving air quality and the episodic control program, and (3) the public begins to understand how individual behavioral changes can affect environmental quality. Surveys are an effective way to gauge the awareness of the public to an episodic control program and the level of behavioral change that occurs on an episodic control day. Often pre- and post-tests are conducted to evaluate the effectiveness of the campaign.

U.S. Environmental Protection Agency

The EPA conducts public outreach via its Web site and printed material.

Explorer Club - EPA maintains a Web site devoted to teaching children about the fundamentals of air pollution, (www.epa.gov/kids/air.htm).

Particulate Matter Pamphlet – EPA has produced an information pamphlet that answers general questions such as: How does PM_{10} affect our health and view? Where does PM_{10} come from? What is being done to reduce PM_{10} and what can I do?

Dust Brochure for Maricopa County - In 1998 EPA promulgated a Federal Implementation Plan (FIP) for PM_{10} for Maricopa County. Attendant to this effort, EPA conducted public outreach in Maricopa County by publishing and distributing a brochure in 1998/99 entitled, "What's All the Fuss About Dust?" The brochure identifies requirements affecting unpaved roads, unpaved parking lots, and disturbed vacant lots in the new EPA FIP. The brochure forewarns the public that the new federal requirements will go into effect on May 1, 1999, and that EPA will make inspections and impose fines thereafter. A Web site address and "800" telephone number for additional information are also provided.

ARIZONA OUTREACH PROGRAMS

State of Arizona

At the statewide level most air quality outreach activities in Arizona have focused on promotion of alternative fuels. Arizona has one of the most attractive set of tax incentives for alternative fuel vehicles and related infrastructure of any state in the Country. Alternative fuels include natural gas, propane, electricity, solar energy, hydrogen, or mixes of natural gas or propane with gasoline or diesel fuel. Biodiesel is not currently included in this list, but is being considered as an addition by the State Legislature.

1. The Arizona Legislature passed S.B. 1427 in 1998 that allows funds from the State Clean Air Fund to be used to conduct public awareness programs for alternative fuels. (A.R.S. 41-1516).
2. The Arizona Department of Commerce Energy Office has published a brochure entitled "Alternative Fuel Vehicle Incentives." The brochure summarizes the tax

credits, tax exemptions, grants, and other benefits (i.e. use of HOV lanes) available to individuals, businesses, and agencies that purchase alternative fuel vehicles and fueling stations.

Arizona Department of Environmental Quality

The Arizona Department of Environmental Quality has not officially adopted an outreach program; however, ADEQ has an outreach procedure to which they adhere. Whenever a regulatory change, such as a modification to a SIP, is called for, a list of affected stakeholders is first identified and compiled. Stakeholders are typically individuals representing regulated sources of air pollution.

The ADEQ has a contract with a communications company that faxes notices of the stakeholder meeting with background material on the proposed regulation, to each of the stakeholders. The meetings are conducted in one of two ways:

- An open forum where participants are provided with hard copies of the regulation with the proposed changes underlined. Stakeholders discuss the changes and make recommendations. After the meeting, ADEQ personnel edit the regulation to incorporate the changes agreed upon and distribute to the stakeholders.
- A regulation-modifying charrette where, by means of a laptop computer and an attached projector, the language to be modified is projected using a word processing application with the "track edits" feature enabled. Proposed changes are entered into the document "live" and discussed during the meeting. After a consensus is reached, the meeting adjourns, and participants are subsequently mailed a hard copy.

After the stakeholders meeting, the regulatory changes are posted on the ADEQ Web site for future reference and further dissemination.

The Arizona Department of Environmental Quality issues high air pollution advisories when carbon monoxide, ozone, or particulate concentrations in Maricopa County are forecasted to approach or exceed federal standards on the following day. During the summer these advisories are typically attributable to high ozone levels. When an advisory is issued between May 1 and September 30, the "Governor's Ozone Alert Program" is triggered. When an advisory is in effect, businesses and organizations participating in the Program are expected to reduce the number of vehicles commuting to their sites by at least ten percent on the next workday. SRP, APS, and Intel are examples of companies participating actively in the Ozone Alert Program.

Maricopa County

The urbanized area of Maricopa County has been classified as a serious nonattainment area for three pollutants: carbon monoxide, ozone, and PM-10. Area agencies including Maricopa

County government, the Maricopa Association of Governments (MAG), and Valley Metro, the regional public transportation authority, are working together to address air quality issues.

Maricopa County has worked with Valley Metro to design a uniform symbol for high air pollution advisory days that is displayed during the weather reports on most of the major network stations. In addition, the local public television station runs a "crawl" which appears at the bottom of the TV screen. High air pollution advisories also appear on the Web home pages for Maricopa County, ADOT, and Valley Metro. The National Weather Service includes tips with its broadcast wire service air quality report on high air pollution advisory days. To combat these air quality problems, the Maricopa County nonattainment area participates in the following air quality outreach programs:

1. Clean Air Campaign - The Clean Air Campaign is a public/private cooperative effort to educate the public about air pollution. The program elements include advertising (radio, billboards, print, etc.), an educational curriculum for grades 1-7, and activities and events for 1500+ employers. Valley Metro conducts the Clean Air Campaign. Co-sponsors of this program are the Arizona Departments of Transportation and Environmental Quality, MAG, Maricopa County, and the Phoenix Chamber of Commerce. The Campaign targets the more than 1,500 employers that are required to implement the Maricopa County Trip Reduction Program (i.e. > 50 employees at a site), as well as, the general public. Promotional kits are mailed to 2,500 employer sites as many as four times per year. Events such as Rideshare Week and Valley Bike Week are conducted to increase awareness of alternative modes of transportation. Other Clean Air Campaign outreach activities include Earth Day, the Fresh Air Science Fair, and Telecommute America. In addition, when the County or State forecasts that a standard may be exceeded, high air pollution advisories and pollution-reduction tips are faxed to over 700 Valley employers.

2. Regional Rideshare Program - The Maricopa Association of Governments sponsors the Rideshare Program in Maricopa County. MAG contracts with Valley Metro to provide regional ridesharing services. The annual budget for the Rideshare Program is approximately $1 million, half of which is provided by federal CMAQ Improvement funds. As part of this program, Valley Metro provides information and assistance to the general public and major employers on carpooling, vanpooling, public transit, park-and-ride lots, and dial-a-ride services. Valley Metro also coordinates with social service agencies to provide transportation for the elderly and handicapped and coordinates with the private sector to develop public/private transportation partnerships. The Rideshare Program provides automated carpool matching lists, transit, dial-a-ride, and park-and-ride information. Two remote on-line terminals are located at Arizona State University and the State Capitol Complex and a portable unit is used at employment sites. The marketing and promotional efforts include posters, brochures, and customized ridesharing messages tailored to individual companies. Other outreach efforts include: carpool matching services offered daily by phone and interactively on the internet home page, areawide awareness and promotion campaign with paid advertising and Employer Transportation Fairs. The rideshare information number is (802) 363-RIDE.

3. Vanpooling Program - Valley Metro assists in acquiring vehicles and forming vanpools. These efforts are focused on employers in the Maricopa County Trip Reduction Program, but the general public is also informed about vanpooling through the Regional Rideshare Program (see above). Outreach activities include: making presentations to employers, providing information to interested parties, performing vanpool matching on a daily basis, conducting vanpool formation meetings at the request of employers, assisting employers in promoting vanpools, and encouraging employers to subsidize the cost of vanpooling by their employees. Valley Metro commits one full-time professional to promote vanpooling. Funding for the capital costs to purchase the vans can be provided by a Federal Transit Administration Section 9 grant (70 percent) with a local match (30 percent). Vanpool operating costs are covered by passenger fares.

4. Trip Reduction Program - Valley Metro provides formal training, offers one-on-one assistance, facilitates Transportation Management Associations (TMAs), and provides informational material to more than 1500 employers in Maricopa County with 50 or more employees at a site. The Program affects more than half a million employees and students at 2,500 sites countywide. A.R.S. 49-591 through 49-593 requires that the Trip Reduction Program be implemented in Maricopa County. Maricopa County contracts with Valley Metro to provide these services. Outreach activities include: employer training (20-60 employees per month), Employer Transportation Fairs, periodic meetings with 14 TMAs and over 400 employer contacts made monthly.

5. Telecommuting, Teleworking, and Teleconferencing Programs - Valley Metro encourages the use of telecommuting and telecommunications to replace motor vehicle trips. These efforts are targeted largely at employers subject to the Trip Reduction Program (i.e. with 50 or more employees at one site). A step-by-step training class is provided to employers planning to implement a telecommuting program. A "how to" implement guidebook is provided to attendees. On-site assistance to employers is available. Valley Metro is proactive in seeking out interested employers and provides management briefings and follow-up consultation until programs are fully operational. Valley Metro maintains a Web site that includes telecommuting information and support materials. Outreach activities include: conducting telecommuting training at least once a month and assisting employers with all stages of implementation. This effort is funded as a part of the combined Valley Metro budget for the Regional Ridesharing Program, Trip Reduction Program, and Clean Air Campaign.

6. Voluntary No-Drive Program - Maricopa County is required by State law (A.R.S. 49-506) to implement a year-round program to encourage commuters to ride the bus, carpool or telecommute one day each week. The Regional Public Transportation Authority promotes this program through the ongoing Trip Reduction and RideShare Programs.

7. Public Information Program on Woodburning Fireplaces - Maricopa County has established a public outreach program to inform and educate citizens about relevant State, local, and EPA regulations; the general health risks of wood smoke; proper woodburning operation and maintenance; heating fuels and practices; new technology stoves; and alternatives to wood heating. The program is supported by two hotlines; fax notifications of high air pollution advisories to the media, agencies and major employers; prepared information sheets for handouts, mailers and bill stuffers; and local newspaper articles. To enhance this program, Maricopa County has published and distributed a Woodburning Booklet (available on the Web), and an educational brochure to inform new homebuyers about high air pollution advisories and promote clean-burning fireplaces. The brochure is being distributed in model homes and by realtors and homebuilders throughout Maricopa County.

8. Clean Cities Workshop – As part of the regional Clean Cities program, the Maricopa Association of Governments conducted a "Clean Fuels for Clean Cities" workshop on April 25, 2000. The purpose of the workshop was to inform the public, businesses, and agencies about the benefits of using alternative fuels to power personal and fleet vehicles. Information was provided in the form of presentations by technical experts and other advocates, panel discussions, exhibits, and test-drives of alternative-fueled vehicles. The workshop was co-sponsored by the Arizona Department of Energy and private corporations. Approximately 300 people attended. Due to the success of this event, MAG is considering conducting additional clean cities workshops in the future.

9. The Maricopa County Department of Transportation (MCDOT) maintains a dust hotline (602) 506-DUST (3878). County residents can call the dust hotline 24-hours a day with questions about dirt road maintenance or paving. A recorded message gives the caller the latest updates on dust issues and allows questions or concerns to be recorded. A MCDOT staff member personally returns each call. McDOT also maintains a Web site that describes their commitment to pave more than 60 miles of high-traveled (i.e. > 150 ADT) unpaved roads in 2000-2003. The specific roads to be paved and a schedule for the paving projects are identified.

10. Agricultural Best Management Practices (BMPs) – In 1998 the Arizona Legislature (ARS 49-457) established a committee and process to develop an agricultural general permit to reduce PM-10 from agricultural sources. Persons who farm more than ten contiguous acres in the Maricopa County PM-10 Nonattainment Area must begin implementing the BMPs by December 31, 2001. The agricultural general permit requires that at least one BMP be implemented to reduce PM-10 from each of the following sources: tillage and harvesting, non-cropland, and cropland. Farmers must keep records documenting the practices they implement. A farmer who does not implement BMPs will be required to submit an implementation plan to the local Natural Resources Conservation District (NRCD). A farmer who does not comply with the NRCD plan must submit an implementation plan to the Arizona Department of Environmental Quality. If the farmer still does not comply with these plans, the general permit may be revoked and the farmer will have to obtain an individual permit from the state. Examples of BMPs include: limiting tillage and soil

preparation activities when wind speeds are 25 mph or higher; reducing vehicle operating speeds to 20 mph on unpaved private farm roads; and constructing artificial wind barriers on or adjacent to croplands. A major public education campaign to inform farmers about the requirements of the new general permit was initiated during the summer of 2000. A booklet describing the new rules and the BMPs has been drafted and will be distributed to agricultural organizations and farmers throughout Maricopa County.

Maricopa County Small Business Environmental Assistance Program

The Maricopa County Environmental Services Department (SBEAP) has developed guidelines for the control of fugitive dust at construction projects and to assist contractors in preparing sites for compliance inspections. Construction activities that cause fugitive dust to be ejected into the atmosphere include earthmoving, land clearing, loading, storage piles, vehicular trackout, and haul roads. Dust control practices are discussed in detail on the SBEAP Web site and also taught in community college courses.

The SBEAP maintains a telephone line for public complaints on environmental issues, including excessive construction dust, smoking vehicles, and any other suspected violations of air quality rules and regulations. The response line operates between 8 a.m. and 5 p.m., Monday through Friday, with voice mail available during other hours. (602) 506-6616.

Community College Courses

The Environmental Health and Safety Technology program at Paradise Valley Community College (PVCC) offers a "Reducing Air Pollution from Construction" course that briefly surveys PM_{10} and other air quality issues. The course is offered each semester on campus. In addition, the half-day course can be scheduled for presentation to large groups of employees of an organization on-site. A sample seminar agenda is shown in Table 6-3.

Attendees receive a bound handout that includes the text of Maricopa County Rule 310 and Earthmoving Permit application forms. The handout also includes the September 2000 version of the "Dust Devil Academy" handbook, including background information on PM_{10}, addresses of useful Web sites and other related information. Attendees receive a "Certificate of Completion" suitable for framing.

Mr. Robert R. Treloar, MT, REP, CET, who conducts the seminar for the college, indicates that the agenda for the session varies depending on the make-up of the class. During the first hour, PM_{10} standards developed by the Environmental Protection Agency are discussed, together with the health effects of PM_{10} and various regulatory options and approaches. During the second hour, Maricopa County air quality staff discuss the construction permit form and fees and the Rule 310 that governs fugitive dust emissions in the County. In the third hour, a slide show presents examples of both acceptable and unacceptable construction activities with respect to fugitive dust emission and control.

Mr. Treloar also instructs an Introduction to Hazardous Materials Technology (HMT 101) course at the college. The one semester, 3-credit course is designed to introduce the student to the environmental hazardous materials technology area. The course consists of 11 modules, one of which pertains to air quality.

Dust Devil Academy

The Dust Devil Academy is a joint effort of ADOT, SBEAP, and the Arizona State University (ASU) College of Engineering & Applied Science, Del E. Webb School of Construction Alliance for Construction Excellence (ACE), and the Del E. Webb School of Construction's Industry Advisory Council. The Dust Devil Academy consists of a 3-Section document that is accessible through both the SBEAP and ACE Web sites. In addition, key elements of the document are available for on-line viewing on the SBEAP site, together with supportive interactive elements suited to the Web environment such as an on-line quiz and an animated depiction of 20 percent opacity. The Community College Course described in the preceding section is considered part of the Dust Devil Academy as well. The Dust Devil Academy represents a significant effort at outreach with respect to the PM_{10} issue. The ADOT outreach research project, of which this technical memorandum is a part, will build upon the Dust Devil Academy work done previously by ASU and SBEAP.

The 154-page Dust Devil Academy Document is presented on both the ACE and SBEAP Web sites (www.maricopa.gov/sbeap/) in Adobe Acrobat format and is available for downloading. This Web site also provides detailed historical data on all monitored pollutants. In addition, real-time air quality reports can be obtained from (602) 420-9458. This line provides recordings of the monitor readings for carbon monoxide, ozone, and particulates for five geographical areas where county monitors are located. These readings are updated hourly at half past the hour.

Pinal County

In 1967, the Pinal County Board of Supervisors formed the Pinal County Air Quality Control District (PCAQCD) which bears primary responsibility for the administration of the County's air quality program. The PCAQCD is an operating Division of the Pinal County Health and Human Services Department.

Since 1997, the Pinal County Air Quality Department has developed an "exceptional events policy" in accord with EPA guidance intended to prevent naturally occurring dust storms and other wind-events from triggering a "nonattainment" designation for particulate matter in the agricultural areas of the County. The Department also petitioned the EPA Administrator to correct the erroneous inclusion of Apache Junction in the Phoenix Planning Area PM_{10} nonattainment area.

As an outreach effort, the Department issued "synthetic minor" permits to every operational facility in the County that wished to avoid possibly falling subject to the "Title V" permit program.

A portion of Pinal County adjacent to the Maricopa County Nonattainment Area, known as "Area A," is also designated as being in nonattainment status for PM_{10}. Effective December 31, 2000, in accordance with Arizona Revised Statutes (A.R.S.)Section 49-541, Area A was expanded to include the area north of Arizona Farms Road and extending 12 miles east from the Maricopa/Pinal county line in the Apache Junction area. Area A includes Apache Junction, Gold Canyon, Queen Creek, San Tan Mountains, and most of what is characterized as Johnson Ranch. The following programs were implemented in Area A of Pinal County:

- An earthmoving activity program, which helps minimize local nuisances and possible impacts to Area A and the particulate matter concentrations
- A Trip Reduction Program, which helps major employers in Area A to implement reductions in vehicle miles traveled by employees
- A "No Burn Ordinance" in Area A for days when the carbon monoxide levels in adjacent Maricopa County may exceed the National Ambient Air Quality Standard for carbon monoxide. This restriction applies to residential wood combustion and permitted open burning.
- A fireplace restriction ordinance that requires "clean burning fireplace standards" for new fireplaces or woodstoves
- Stage I and stage II vapor recovery systems are required at some gas dispensing sites
- Mandatory emission testing for all vehicles used by residents in Area A and those who commute to work in Area A

Those who inquire about PM_{10} issues or earthmoving permits are provided with a packet of information including a "Dust Control" brochure, and a brochure of information about the Dust Devil Academy "Reducing Air Pollution from Construction" classes offered at Paradise Valley Community College. Also included in the packet are a hard copy of the home page of the PCAQCD Web site, a map of Area A, a hard copy of a PowerPoint presentation explaining the Earthmoving Activity Registration Orientation Program, applicable County regulations, and a registration application.

Pinal County's Air Quality Web site home page contains links to the following:

- A or B Permit Procedures
- Air Quality Status
- Asbestos Program (PDF File)
- Definitions
- Nonattainment Map
- Organizational Chart
- What's New?
- Accomplishments
- Area A Map
- Code of Regulations
- Legal Authority
- Objectives
- Programs
- Workload/Performance

In addition, the following forms are available for downloading in either Adobe Acrobat or Microsoft Word format:

- Earthmoving Registration
- Burn Permit Application
- Class A or B Permit
- Emission Source
- Asbestos Notification

Yavapai Air Aware

In 1999, the Yavapai Area Governments and Prescott College participated in a pilot air quality sustainability study, sponsored by ADOT that identified an educational/outreach program as an important strategy to sustain clean air in Central Yavapai County.

Yavapai County "Air Aware," also funded by ADOT, is the follow-up effort to develop and implement the educational/outreach program. The program is sponsored by Central Yavapai County governments, including the City of Prescott, the Towns of Prescott Valley and Chino Valley, and the Yavapai-Prescott Indian Tribe. "Air Aware" encourages voluntary efforts on the part of individuals, businesses, and local governments to keep the air of the area clean, even as significant population growth in the region is anticipated over the next twenty years. The goal is to avoid the adverse medical, environmental, lifestyle, and economic impacts of unhealthy air.

Outreach tools developed—or being developed—by Yavapai "Air Aware" include:

- A comprehensive Web site hosted by ADOT
- Mass Mailings
- Curriculum Materials for Educators
- Public Service Announcements
- Field Manuals
- Speakers' Bureau
- Outreach Database
- Press Releases

Area jurisdictions represented are also encouraged to adopt an ordinance that would ban wood-burning fireplaces (unless they are clean-burning by EPA standards) in new residential construction. Additional "Air Aware" sponsors include the Central Yavapai Transportation Planning Organization, the Prescott Chamber of Commerce, and Prescott Alternative Transportation, a private sector advocacy group.

Governor's Agricultural Best Management Practices Committee

In 1998, the Arizona Legislature created an Agricultural Best Management Practices Committee consisting of the ADEQ Director, the director of the Department of Agriculture, a soil specialist from the University of Arizona college of Agriculture, and representative producers of citrus, vegetables, cotton, alfalfa, and grain. In May 2000, the committee adopted a set of best management practices to control fugitive dust produced by agricultural activities within the Maricopa County PM_{10} Nonattainment Area. The committee developed an outreach document, "Guide to Agricultural PM_{10} Best Management Practices," that effectively summarizes the PM_{10} issue and, in clear and concise terms, presents the best management practices for a variety of agricultural activities. This document could serve as a model for a "Guide to Construction PM_{10} Best Management Practices" developed along similar lines.

The committee also produced a two-page brochure called "How Agriculture is Improving Maricopa County's Air Quality." This brochure addresses the following questions: What is PM-10? Why Should I Be Concerned About PM-10? How Can We Reduce the Levels of Dust in Maricopa County? What Does the General Permit Require? When Will Farmers Have to Comply with the General Permit? Where Can I Learn More?

In addition, the Natural Resources Conservation District and other stakeholders sponsored two workshops to inform Maricopa County farmers of the new PM-10 requirements. A brochure called "Farmers Must Comply...New Air Quality Regulations" was prepared to invite local farmers to attend the workshops. The topics addressed in this brochure were: What is PM-10? What Do the New Regulations Require? Why? Who Has to Comply? When? Workshops were conducted in Mesa on February 20, 2000, for East Valley farmers and in Avondale on March 1, 2000, for West Valley farmers. More than 300 farmers attended these two events.

Arizona Local Technical Assistance Program (LTAP)

The National LTAP was established in 1981 as the Rural Technical Assistance Program by the Federal Highway Administration (FHWA) to help local transportation agencies learn about maintaining and improving their roads and about state-of-the-art technology in the construction and maintenance of roadways and bridges.

The Arizona Department of Transportation partners with the FHWA to provide technology transfer assistance for local road and bridge agencies through Arizona's LTAP.

The LTAP program has the following objectives:

1. To establish a system to improve the exchange of information between local agencies, ADOT, FHWA, private transportation entities and universities.

2. To encourage implementation of effective procedures and technology at the local level.

Arizona LTAP provides the following outreach services:

- A membership database for newsletter and technical material distribution.
- The bi-monthly *Tapping In* newsletter and information brochures
- A Media Center library with publications and more than 500 videos for loan covering every aspect of the road and bridge profession, with particular emphasis on safety.
- Professional training in many formats.
- A local agency link between state, national, and international pending, current, and completed research.
- The development, participation in, and coordination of the distribution of a variety of transportation safety-related programs and products
- Web site and on-line discussion group

Construction Industry Outreach in Maricopa County

Rising concerns about the contribution of construction activities to levels of fugitive dust in Maricopa County, together with the County's increasingly aggressive enforcement of Rule 310, have motivated local construction industry organizations to develop air quality outreach policies, or to support the development of outreach programs by others.

These organizations include

- Arizona Builders Alliance (ABA)
- Arizona Contractors Association (ACA)
- Home Builders Association of Central Arizona (HBACA)
- Arizona Chapter, Associated General Contractors (AGC)

The executive director of the ABA, Mark Minter, supports the concept of a comprehensive Web site explaining the basics of Rule 310 and providing instructions for implementing the Best Practice for each dust generating activity, along with supportive collateral to drive persons to the Web site. The ABA believes that dust control procedures must be included in the design of projects.

Specific outreach suggestions by ABA Safety Committee members include widespread use of the new "Effective Dust Control and Overview of Rule 310" videos, as well as the design of a poster outlining the "Dirty Dozen" actions to avoid, in pursuit of dust control.

The ACA and Maricopa County set up a "Membership Mixer" for Association Members and County officials to discuss in a relaxed atmosphere the issues surrounding PM_{10} dust control compliance. In addition, the Association scheduled other meetings to educate its members on PM_{10} by inviting County officials to lead discussions on the subject. The Association makes use of its newsletter to inform its members on PM_{10} issues as changes in regulation or management practices occur. The ACA obtains current information from various public sector Web sites for dissemination to its membership by means of the newsletter, word-of-mouth, and other methods. Pinal County contacted the Association and volunteered information on its standards for PM_{10} that was also conveyed to ACA members. The ACA does not have a structured "outreach program," as such, but makes use of membership mixers, other meetings, newsletters, and Web sites to inform its members.

The HBACA has implemented a comprehensive general outreach program including a 17-week superintendent training program addressing issues such as safety, legal issues, and industry practices into which a dust control module could possibly be incorporated. The association has developed both English and Spanish versions of a "pocket flip book" containing basic job site safety rules and procedures illustrated with cartoons.

The association recently received a supply of the "Effective Dust Control and Overview of Rule 310" videos distribution to HBACA members on request. The HBACA has also been proactively involved in resolving dust control disputes involving members who have been fined.

Nearly all of the firms that perform contract work for ADOT are members of the AGC-Arizona Chapter, and AGC anticipates that its membership will be more immediately impacted by ADOT adoption and implementation of a dust control outreach program than those of other construction industry associations.

The AGC currently conducts safety-related outreach training as a service to AGC membership for a fee that represents supplemental income to the AGC, and has suggested that a similar approach could be used for air quality and dust control outreach. If, for example, the County could establish training guidelines and a curriculum for a dust control training course, AGC and the other construction industry associations could offer the course program to their members.

In addition to the outreach being conducted by construction industry organizations, some Phoenix-area construction firms such as Kitchell Contractors are conducting their own outreach efforts.

Mr. Jeff Lange, Safety and Risk Manager for the firm, has designed a trackout control device for use on Kitchell projects. The device is portable, reusable, can be transported by pick-up truck, is easy to assemble, and can have any number of sections added to it to extend its length. The device can be secured with gravel or can be staked to the ground or to a paved surface. Additional information is available at (www.trackoutcontrol.com).

In addition to developing and promoting the trackout control devise, Jeff Lange has guided the development of an "Environmental Construction Management Program" (ECMP). This program was developed in cooperation with the Maricopa County Environmental Services Department in association with the Arizona Department of Environmental Quality and the EPA. Kitchell claims that the ECMP will generate the following benefits for the construction industry:

- Add value to the community
  - ✓ Avoid complaints
  - ✓ Promote a "good neighbor" approach to construction
- Aid in identifying avoidable costs
  - ✓ Remediation fees
  - ✓ Litigation fees
  - ✓ Down-time losses
  - ✓ Avoid liquidated damages
  - ✓ Insurance premiums
  - ✓ Workers compensation
  - ✓ Loss time
- Minimize the health risks associated with dust and airborne particulates
- Protect our community's environment

The ECMP will consist of six prime areas of focus: air quality, hazardous waste, solid waste, wastewater, education and training, and tracking. The Air Quality element includes the implementation of dust control measures. The Education and Training element provides for

use of site safety plans, the publishing of a Corporate Safety Manual, and the incorporation of ECMP training into Safety Meetings.

TABLE 6-1. SUMMARY OF AIR QUALITY OUTREACH PROGRAMS

	Program Sponsors															
Type of Program	**ALA, Gulf-Coast, FL**	**Atlanta Region**	**State of Arizona**	**Bakersfield California**	**California ARB**	**Denver Region**	**Las Vegas Region**	**Louisiana DEQ**	**Mohave Desert AQMD**	**State of Oklahoma**	**Oklahoma City Region**	**Oregon DEQ**	**Phoenix Region**	**Seattle Region**	**Tulsa Region**	**U.S. EPA**
Educational Materials/Projects	X	X		X				X	X	X				X	X	X
Pollution Alert Days		X				X					X		X	X	X	
Clean Air Campaign		X											X			
Rideshare Program		X		X									X		X	
Air Quality Report Card		X													X	
News Releases, Media Events		X				X			X				X		X	
Monitoring Data on Web site		X							X				X		X	
Alternative Fuels Tax Incentives			X													
Clean Cities											X		X		X	
Tips for Cleaner Air			X		X		X					X		X	X	
Fact Sheets, Pamphlets, Speakers		X			X	X				X		X		X		X
Grants, Awards, Contests									X	X					X	
Local Government Programs						X										
Business Environmental Assistance													X	X		
Complaint Hotline(s)		X											X		X	
AQ Rules and Regs on Web site									X				X	X		
Information on Woodburning													X	X		

TABLE 6-2. UNIQUE AIR QUALITY OUTREACH PROGRAMS

Sponsors	Programs
Atlanta Region	Air Quality Summit in Regional Vision 2020 Planning Process
California ARB	Card Catalogue Database; Voluntary Accelerated Vehicle Retirement
Denver Region	Voluntary Reductions in Reid Vapor Pressure by Petroleum Industry and in Spillage and Evaporative Emissions at Gas Stations; On-line Ozone Awareness Survey; Smart Signs
Oklahoma City Region	Flexible Attainment Region (FAR) for Carbon Monoxide
Phoenix Region	Trip Reduction Program (Mandatory for Sites > 50 Employees); Telecommuting/Teleworking Program; Voluntary No-Drive in Five Program; Agricultural Best Management Practices[1]
Tulsa Region	First Flexible Attainment Region (FAR) for Ozone

[1]South Coast Air Quality Management District has a similar PM-10 outreach program for local farmers.

TABLE 6-3. SAMPLE AGENDA - REDUCING AIR POLLUTION FROM CONSTRUCTION SEMINAR

Time Allotted	Agenda Topics
9:00 a.m. - 9:05 a.m.	Review of resource materials and course objectives
9:05 a.m. - 9:10 a.m.	Background information
9:10 a.m. - 9:50 a.m.	Overview of reducing air pollution from construction
9:50 a.m. - 10:00 a.m.	Break
10:00 a.m. - 10:15 a.m.	Continuation of overview
10:15 a.m. - 10:30 a.m.	Permit form and fees
10:40 a.m. - 10:50 a.m.	Survey of guidebook
10:50 a.m. - 11:00 a.m.	Break
11:50 a.m. - 12:00 Noon	Q & A and awarding of certificates

Source: Paradise Valley Community College, Environmental Health and Safety Technology Program

CHAPTER 7. AREA PLANS AND PROGRAMS

COCONINO COUNTY CAPITAL IMPROVEMENT PLAN

The County's Capital Improvement Plan includes many items that will have the combined effect of reducing vehicle miles traveled and reducing air pollutants and particulates generated by motor vehicles. The Public Transit Five Year Work Plan for Fiscal Years 2002 through 2006 is shown in Table 7-1. The Public Works Plan for the same fiscal years is shown in Table 7-2.

VISION 2020

The Flagstaff Vision 2020 process identified environmental and transportation goals and strategies for greater Flagstaff. Based on a comprehensive visioning and action planning process, the community created vision, goals, and actions plans to balance social well-being, economic health, and environmental quality in the ongoing growth and development of the community. The process stressed that the community has a high desire in the Flagstaff area to become a pedestrian-oriented city. The transportation-related goals and strategies of the Vision 2020 process are shown in Table 7-3. The environmental goals and strategies are shown in Table 7-4.

DRAFT FLAGSTAFF AREA REGIONAL LAND USE AND TRANSPORTATION PLAN

The *Draft Flagstaff Area Regional Land Use and Transportation Plan* adopted the following Air Quality Policy:

> *Protect and improve air quality by implementation of air quality programs including but not limited to reducing the growth rate of total vehicle-miles of travel in the greater Flagstaff area, reducing the total emissions of high priority pollutants from commercial and industrial sources, and reducing area-wide smoke emissions.*

The air policy strategies adopted in support of this policy are shown in Table 7-5.

The Plan also identified the following mobility issues for the Flagstaff area:

- Lack of sidewalks
- Sidewalks that are too narrow and too close to the road
- Poor street crossings
- Public transit service is minimal

However, as noted above, current mobility options are limited, but the Draft Flagstaff Area Regional Land Use and Transportation Plan notes that:

Compared to other cities in the mountainous west, Flagstaff has the potential for 25 percent of the person trips as pedestrian, walking, or bicycling trips.

This Plan is intended to guide future land use decisions in the City of Flagstaff and surrounding area, as defined by the boundary of the Metropolitan Planning Organization. Recognizing the existing physical conditions and planning influences of the region, the plan provides policy direction and the community's vision for the future development of the area. The plan is written guided by the following vision:

Our vision is that Greater Flagstaff will have a compact land use pattern that shapes growth in a manner that preserves our region's natural environment, livability, and sense of community. By directing growth to well-defined contiguous areas, growth can be better accommodated without encouraging inefficient land use patterns; open lands and natural resources can be better protected; and public facilities and services can be delivered more effectively. With a finite supply of land, the plan shall provide for the region's growth in a manner that balances growth and conservation.

The vision of the plan includes the following key objectives:

- Efficient use of land
- Appropriate land use patterns
- Regional cooperation
- Preservation of open lands
- Economic development opportunities
- Mobility and transportation choices
- Preserving rural character
- Greater opportunities for affordable housing
- Preserve and enhance natural resources
- Promote quality design

Transportation Plan Element

The transportation element of the regional plan was an important step in defining how Flagstaff should grow and how the transportation infrastructure should be planned:

...to achieve a balanced reliance on multiple transportation modes: single-occupant vehicles, multi-occupant vehicles, public transit, bicycling and walking. This balance will enable the Flagstaff metropolitan area to attain high levels of mobility and accessibility while preserving community character and quality of life.

To achieve this balance two major strategies are outlined. First, the plan recommends increasing the investment in public transit, bicycling, and walking systems with the goal to balance the past emphasis on investments in roadway capacity. Secondly, the needs of other

modes must be incorporated into the design of roadway improvements.

The transportation plan is intended to compliment the *Flagstaff Area Regional Land Use and Development Plan*; therefore, aims at supporting a compact, efficient urban form while at the same time protecting and enhancing existing neighborhoods and commercial areas.

Transit System Plan Element

Based on goals identified in the Flagstaff Area Regional Land Use and Development Plan transit is envisioned to be a "genuine choice, financially accountable, a growth management tool, and integrated into a multi-modal system." Specifically, four service needs are identified: fast cross-town travel, higher service frequency, core area circulation, and an efficient transfer system. The planned future transit service will be based on an express spine route operating along Milton Avenue and West Route 66, a core area circulator connecting major downtown destinations, and local routes serving individual neighborhoods.

Non-Motorized Systems

Recognized as critically important, a good pedestrian and bicycling system throughout the region and especially in the core areas is envisioned. Therefore, major emphasis is placed on improving sidewalks, crosswalks and other walkways in order to develop a safe, continuos, well connected pedestrian system. Improved design standards will be implemented through the incorporation in road projects.

FLAGSTAFF URBAN TRAIL SYSTEM (FUTS)

Started in 1989, the FUTS is laid out as a recreational and alternative transportation system both within the city and connecting to surrounding national forest areas. The FUTS links are designed as off-street pathways, separated from and independent of the street system. The intent is to link the various parts of the city utilizing green belts, and or using separate right-of-way acquired or dedicated.

NORTHERN ARIZONA UNIVERSITY CAMPUS MASTER PLAN

This plan, completed in 2001, is based on six major planning principles:

- A premier residential campus has a unique identity with several aspects not widely duplicated.
- A premier residential campus has a visual identity.
- The campus should have special indoor and outdoor places that make it a special experience.
- The campus should be pedestrian, bicycle, and transit friendly.
- The campus should be a lively place.
- A premier residential campus is customer responsive.

Two specific goals define the University's vision in regard to transportation on campus is to make the Campus pedestrian, bicycles and transit friendly, as well as to provide access without the automobile orientation.

The first goal is to establish a Campus, which is not dominated by automobile traffic, and subsequent improvements for transit, bicycling, and pedestrians are anticipated. The second goal of the plan addresses the connections to the community and the Interstate Highway System. Northern Arizona University sees itself as integral part of the community and recognizes that the Campus needs to be connected to the community. Highlighting the positive relationship between the city and the university, the following four major opportunities are identified in the master plan.

- Improvement of the clear sense of arrival at the Campus
- Connections to the adjacent community can be improved
- Possible positive effects of Lone Tree Interchange
- Limit through traffic on Campus

SOLID FUEL BURNING ORDINANCE

In response to concerns about air pollution in the form in PM10, Polycyclic Organic Matter (PCM), and carbon monoxide, the Flagstaff City Council adopted Ordinance No. 1664 on June 5, 1990. The ordinance contains the following provisions:

- Wood heaters or fireplace inserts that do not meet EPA Phase II standards cannot be sold or installed within the City of Flagstaff
- Coal burning is outlawed within city limits
- A permit must be obtained before installing a woodburning heater or fireplace
- The heater or fireplace must be installed according to manufacturer's specifications and must not be operated until inspected and approved
- Selling or installing a heater or fireplace without first obtaining a permit is unlawful

- Violations of the provisions are punishable by a schedule of applicable fines

DARK SKIES PROGRAM

The City of Flagstaff has been an international leader in successfully developing and promoting the "Dark Skies" concept. Dark Skies issues are analogous to those concerning the preservation and improvement of visibility during daylight hours. Indeed, airborne particles that create haze during the day contribute to "sky shine" after dark, impacting the operation of observatories and other astronomical instruments.

Dark Sky Issues [7] include:

- Most existing astronomical observatories are suffering from light pollution, radio interference, or effects of space debris. Amateurs and professionals alike are adversely affected by these environmental problems. Observatories are increasingly being threatened by these problems.
- Observatories in space, built at great cost, may be seriously affected by man-made orbiting space debris.
- All planning of future observatories on Earth and in space must take environmental deterioration into account and include provision for controlling such adverse impacts on their operation.
- The profoundly human experience of the inspiring beauty of the night sky is at risk for all people, not just scientists, as light pollution destroys our view of the cosmos.
- Quality lighting is the key to reducing light pollution. It means better visibility at night, freedom from glare, and very significant energy savings. Everyone wins.

TABLE 7-1. PUBLIC TRANSIT FIVE-YEAR WORK PLAN - FISCAL YEARS 2002 – 2006

Project Name	Revised Project Budget	Estimated to be expended thru FY01	FY 02 Budget	FY 03 Plan	FY 04 Plan	FY 05 Plan	FY 06 Plan
Renovation of a New Mountain Line Transit Facility	$350,000	$11,487	$338,513	$0	$0	$0	$0
Purchase Special Needs Vans	$1,032,789	$0	$105,000	$0	$495,370	$0	$432,419
Purchase Mountain Line Transit System Buses	$1,395,000	$0	$1,290,000	$0	$105,500	$0	$0

Source: Coconino County Capital Improvement Plan

TABLE 7-2. COCONINO COUNTY PUBLIC WORKS FIVE-YEAR WORK PLAN - FISCAL YEARS 2002 – 2006

Project Name	Revised Project Budget	Estimated to be expended thru FY01	FY 02 Budget	FY 03 Plan	FY 04 Plan	FY 05 Plan	FY 06 Plan
Thin Over-lay Program for Various Roads	$1,500,000	$250,000	$250,000	$250,000	$250,000	$250,000	$250,000
Clear Creek Pines Access Realignment/Widening	$1,090,000	$630,000	$460,000	$0	$0	$0	$0
	$315,000	$0	$315,000	$0	$0	$0	$0
Lake Mary Rd Milepost 305 Recycle:Road preservation	$5,445,000	$0	$1,875,000	$0	$2,070,000	$1,500,000	$0
Ft. Tuthill Access - Connection to 89A	$43,000	$0	$43,000	$0	$0	$0	$0
Silver Saddle Rd: Reconstruction/vert. Realignment	$1,250,000	$0	$1,250,000	$0	$0	$0	$0
Ft. Tuthill Cinder Storage	$420,000	$0	$420,000	$0	$0	$0	$0
Kaibab Estates Equipment Storage Building	$98,000	$0	$98,000	$0	$0	$0	$0
Clear Creek Pines Paving Project	$695,000	$0	$695,000	$0	$0	$0	$0
Equipment Replacement Schedule	$6,240,000	$0	$980,000	$1,260,000	$1,360,000	$1,300,000	$1,340,000
Peaks View Park Right-of-Way	$200,000	$0	$200,000	$0	$0	$0	$0
Maintenance Management System Software	$50,000	$0	$50,000	$0	$0	$0	$0
Grade, drain, and surfacing of BIA Route 6720	$102,000	$0	$102,000	$0	$0	$0	$0
OSHA Spreader Racks - Construct new	$620,000	$0	$620,000	$0	$0	$0	$0
Air Curtain Destructor - to prevent extra smoke	$65,000	$0	$65,000	$0	$0	$0	$0
Replacement of (30) trucks	$780,000	$0	$780,000	$0	$0	$0	$0
Replacement of (9) sedans	$195,000	$0	$195,000	$0	$0	$0	$0
Purchase 2 snowmobiles/1 trailer (Search & Rescue)	$16,700	$0	$16,700	$0	$0	$0	$0
Fort Tuthill Access Realignment and widening	$532,500	$0	$532,500	$0	$0	$0	$0
Relocation of Fort Tuthill Equipment Storage	$468,000	$0	$468,000	$0	$0	$0	$0
Build Mormon Lake Storage Building	$165,000	$0	$165,000	$0	$0	$0	$0
Right-Of-Way recurring	$150,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000
Purchase a Recovery/lift Body	$85,000	$0	$85,000	$0	$0	$0	$0
Purchase Two 10-wheel Dump Trucks	$241,500	$0	$241,500	$0	$0	$0	$0
Radio Consultant & Repeaters Equipment	$150,000	$0	$150,000	$0	$0	$0	$0

Source: Coconino County Capital Improvement Plan, - Fiscal Years 2002 – 2006

TABLE 7-3. VISION 2020 TRANSPORTATION RELATED GOALS AND STRATEGIES

Goal: Develop convenient, user friendly transportation systems throughout the region.	
	Strategy: Undertake education campaign to encourage use of alternative transportation
	Strategy: Expand and improve the existing bus system
	Strategy: Promote and develop comprehensive and multiple trail systems for bikes and pedestrians
	Strategy: Expand and improve the existing street system
Goal: Develop and implement a comprehensive transportation plan within the Greater Flagstaff Region addressing both short- and long-term needs, and emphasizing alternative transportation modes	
	Strategy: Plan and initiate a regional multi model transportation program
	Strategy: Coordinate regional land use and transportation plans into a single seamless document
	Strategy Re-examine and redesign north/south transportation routes: auto, bicycle, pedestrian, including railroad crossings and South Milton Road
Goal: Flagstaff promotes community design and employs design standards that reflect and enhance the community's unique history, cultural, and natural and built environments	
	Strategy: Enhance the appeal of the gateways to the City and the surrounding communities of the greater Flagstaff area
	Strategy: Enhance the appeal of transportation corridors of the City and the surrounding communities of the greater Flagstaff area
Goal: Downtown is the economic, cultural, and governmental hub of the region and is pedestrian oriented and easily accessible	
	Strategy: Promote the expansion of pedestrian and multimodal access

Source: *A Vision For Our Community Flagstaff 2020*

TABLE 7-4. VISION 2020 ENVIRONMENT RELATED GOALS AND STRATEGIES

Goal: To establish and implement guidelines/standards that define "environmentally friendly, green" industry, to be used in recruiting new businesses and to assist existing businesses
Strategy: Collect available information on defined standards/guidelines from other communities and government agencies
Strategy: Determine acceptable levels of water use and air emissions and acceptable types and levels of solid and hazardous waste generation
Strategy: Establish environmental risk vs. economic benefit ratios in a numerical format that are acceptable to the Greater Flagstaff community
Goal: To develop and implement policies and incentives to maximize the 3 R's (reduce, reuse, recycle) of solid waste in homes and businesses
Strategy: Coordinate rates with a "pay-as-you-throw" system
Strategy: Maximize waste diversion at the landfill site
Strategy: Create a sense of urgency in regional governments about waste management
Goal: To develop and implement policies and incentives for environmentally-friendly construction and renovation of homes and businesses
Strategy: Gather and distribute information on current standards and best available technology
Strategy: Encourage building professionals and property owners to use environmentally-friendly construction methods
Strategy: Modify construction regulations to promote environmentally friendly construction methods
Goal: To develop and adopt an interjurisdictional Community Design Plan and guidelines for how the greater Flagstaff community will grow to protect natural beauty and resources
Strategy: Develop and gain acceptance by the public and City and County governments of a Community Design Plan that protects the environment
Strategy: Compile acceptable non-traditional alternatives for neighborhoods to retain open space in the design plan
Goal: To ensure that the Open Spaces and Greenways Plan is adopted and implemented
Strategy: Support approval process by the City and County governments and participating agencies
Strategy: Form an OSGW Coalition to ensure implementation of OSGW Plan
Strategy: Acquire and retain the Plan's designated open spaces and greenways
Goal: To implement a comprehensive management plan for ground/surface water and riparian areas
Strategy: Clarify and communicate to the public the quantity and quality of groundwater that is available and the level of use that is sustainable in the Flagstaff region; include a determination of the effect of groundwater draw down on area springs
Strategy: Build a sense of stewardship in the community for the water resources of the region

Source: *A Vision For Our Community Flagstaff 2020*

TABLE 7-5. DRAFT FLAGSTAFF AREA REGIONAL LAND USE AND TRANSPORTATION PLAN AIR QUALITY STRATEGIES

Strategy	Responsible Party	Time Frame/ Years
Strategy NCR1.1(a)—Monitor and Adopt Air Quality Programs Monitor and determine acceptable standards for particulate matter	City & County	0-3
Strategy NCR1.1(b)—Adopt Vehicular Air Quality Maintenance Programs Adopt air quality maintenance programs to reduce total vehicle-miles of travel in the Flagstaff area, such as requiring connectivity and other measurer to support non-vehicular travel, including actions designed to help implement demand-side strategies.	City & County	0-1
Strategy NCR1.1(c)—Investigate Use of Alternative Roadway Construction Materials Investigate and, where appropriate, use alternative materials, other than concrete and asphalt, to reduce air-borne particulates of unpaved roadways	City & County, ADOT	1-3
Strategy NCR1.1(d)—Investigate Possibility of Emissions Testing Program Investigate feasibility of an automobile emissions testing program for the region.	City & County	1-3

Source: *Flagstaff Area Regional Land Use And Development Plan*

REFERENCES

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5. Arizona Department of Environmental Quality, *2001 Annual Report*

6. Federal Highway Administration, *Transportation Air Quality, Selected Facts and Figures*, January 1999.

7. Keyes, et. al., "Estimating the Costs of Violating Air Quality Standards", Air and Waste Management Journal, April, 2001, page 22.

8. International Dark-Sky Association, www.darksky.org